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REMEDIAL INVESTIGATION WORK PLAN INTRODUCTION FOR MUNITIONS RESPONSE
PROGRAM UNEXPLODED ORDNANCE SITES 2, 3, 4, 5, 6, 7 AND 8 MCRD PARRIS ISLAND
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Remedial Investigation Work Plan Munitions Response Program

Introduction Unexploded Ordnance Sites 2, 3, 4, 5, 6, 7, 8

Marine Corps Recruit Depot Parris Island Parris Island, South Carolina



Naval Facilities Engineering Command Southeast

**Contract Number N62470-08-D-1001
Contract Task Order JM10**

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FINAL – REVISION 1

REMEDIAL INVESTIGATION WORK PLAN

for

MUNITIONS RESPONSE PROGRAM

UNEXPLODED ORDNANCE SITES 2, 3, 4, 5, 6, 7, and 8

MARINE CORPS RECRUIT DEPOT PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

May 2012

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INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this Remedial Investigation Work Plan (RIWP) on behalf of Naval Facilities Engineering Command (NAVFAC) Southeast (SE) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001 Contract Task Order (CTO) JM10. This plan has been prepared to support a Remedial Investigation (RI) of seven Munitions Response Areas (MRAs), identified as Unexploded Ordnance (UXO) Sites 2 to 8 under the Navy's Munitions Response Program (MRP). These sites are located at Marine Corps Recruit Depot (MCRD) Parris Island in Parris Island, South Carolina. The location of MCRD Parris Island is shown on [Figure INT-1](#). The locations of the seven MRAs are shown on [Figure INT-2](#).

The Navy and Marine Corps have conducted various testing, training, and disposal activities related to military munitions at MCRD Parris Island since its establishment in 1915 as a recruit training facility. As a result of these activities, Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) may be present at various sites throughout the facility. The term MEC includes Discarded Military Munitions (DMM), UXO, and MC in high enough concentrations to pose an explosive hazard. MC is any material originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and the emission, degradation, or breakdown elements of such ordnance or munitions. These and other munitions-related terms that are used in this RIWP have been defined by Navy Sea Systems Command (NAVSEA) in NAVSEA OP-5, Appendix A (Definitions and Abbreviations). For ease of reference, the NAVSEA definitions relevant to this investigation are included in this RIWP Introduction as [Appendix A](#).

The subject of this RIWP is the investigation of MEC and MC at the MCRD Parris Island UXO sites. The RIWP consists of four volumes including this Introduction, a two-part Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP), and an Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP). Part 1 of the SAP contains the MEC investigative plan for sites known or suspected to contain MEC (UXO Sites 3 to 8); and Part 2 of the SAP contains the MC investigative plan for sites known or suspected to contain MC (UXO Sites 2 to 8). The APP/SSHP, which addresses fieldwork to be conducted under both parts of the SAP, has been submitted to the Navy under separate cover and approved for use during fieldwork.

The background information and investigative approaches presented in this RIWP were developed based on results of a Site Inspection (SI) conducted in 2010 (Tetra Tech, 2011), and on input received from the Partnering Team during project scoping meetings and in written comments pursuant to their review of the SI Report. The Partnering Team consists of representatives of NAVFAC SE, MCRD Parris Island, United States Environmental Protection Agency (USEPA) Region 4, South Carolina Department of Health and

Environmental Control (SCDHEC), and Tetra Tech. The Team agreed that comments and recommendations received from USEPA and SCDHEC on the SI Report be incorporated into this RIWP, as described in the response-to-comment letters that were appended to the draft version of this plan. This Final (Revision 1) RIWP incorporates responses to comments received from USEPA, SCDHEC, and one of the Natural Resources Trustees subsequent to their review of the Draft and Final (Revision 0) RI planning documents, which are included in this Introduction as [Appendix B](#). Responses to comments received from the Navy Chemist prior to his approval of the MC SAP are also included in [Appendix B](#), as requested by USEPA. The Navy MRP Senior Technical Advisor granted approval of the MEC SAP with no comments.

1.0 MUNITIONS RESPONSE PROGRAM

Pursuant to the passage of the National Defense Authorization Act for Fiscal Year 2002 (U.S. Congress, 2001), the Department of Defense (DoD) established the Military Munitions Response Program (MMRP) to address MC and MEC at “other than operational” ranges. The Department of the Navy (DoN) is responsible for implementing the MMRP at MCRD Parris Island, and is doing so under its own MRP, as described in the Department of the Navy Environmental Restoration Program Manual (DoN, 2006). The DoN MRP follows a process consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

An Archive Search Report (ASR) and a Range Identification and Preliminary Range Assessment (RIPRA) were completed for MCRD Parris Island in May 1999. A summary of the ranges evaluated was provided in the responses to SCDHEC comments on the SI Report, dated August 3, 2011, which were appended to the draft version of this plan. [Figure INT-3](#) shows the approximate locations and boundaries, if known, of the ranges identified in the RIPRA, as well as the locations of all active ranges and training areas identified by MCRD Parris Island. A table is included in [Appendix C](#) that lists the ranges identified in the RIPRA, indicates the status of each (e.g., Active, Inactive, or Discontinued), , and describes the location of the ranges on [Figure INT-3](#).

Based on findings presented in the ASR and RIPRA [United States Army Corps of Engineers (USACE), 1999a and b], the following “other than operational” ranges were identified as MRAs at MCRD Parris Island and selected for further evaluation and/or field investigation under the MRP:

- Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area (UXO 1),
- Rifle Range at Ballast Creek (UXO 2),
- Aerial Bombing Target at Parade Deck (UXO 3),
- Field Artillery West Main Range (UXO 4),
- Field Artillery East Shrapnel Range (UXO 5 and UXO 6),

- Aerial Bombing Target at Golf Course (UXO 7), and
- Aerial Bombing Target at Southern Tidal Flats (UXO 8).

Areas associated with active ranges (as indicated by orange highlighting on Figure INT-2, INT-3, and other figures throughout the RIWP) are not subject to the MRP and, thus, are not considered part of the UXO investigation areas. These ranges will be investigated at a later date following the permanent termination of firing activities and the subsequent re-classification of these ranges as other than operational.

2.0 SITE INSPECTION

In keeping with the CERCLA process, the Navy conducted an SI of the eight MCRD Parris Island MRP sites in 2010. The SI field investigation covered seven of the eight sites and included detector-aided (magnetometer) surveys to identify MEC and Material Potentially Presenting an Explosive Hazard (MPPEH) on the ground surface, land-based and aquatic geophysical surveys to identify anomalies that might indicate the presence of subsurface or submerged MEC or MPPEH, and the collection and analysis of surface soil and sediment samples to evaluate MC in potentially impacted environmental media. A summary of the SI activities conducted at each UXO site is presented in [Table INT-1](#).

Results of the SI field investigation and subsequent human health and ecological risk screening are provided in the SI Report (Tetra Tech, 2011). Based on the SI results and on further evaluation of the remaining data gaps, as identified by the Partnering Team (see [Table INT-2](#)), UXO Sites 1 and 2 were recommended for additional data collection under an Expanded SI, and UXO Sites 3 to 8 were recommended for additional data collection under an RI so that risk evaluations [e.g., Hazard Assessment (HA), Human Health Risk Assessment (HHRA), and Ecological Risk Assessment (ERA)] can be completed for each site.

Further investigation was recommended for the presumed location of UXO 1, as identified in the ASR/RIPRA, because there was uncertainty associated with whether this site actually existed. The identification of this site was based on the recollections of a single credible witness, but could not be confirmed through historical records or photographs. No field data were collected at this site during the initial SI phase; therefore, an Expanded SI was proposed to determine whether any physical evidence exists that could be used to confirm or refute the historical use of this location as a grenade range. The need for further investigation at this site is currently under review by a Navy panel.

Further investigation was also recommended for UXO 2 because the data collected during the SI at this site were deemed insufficient to delineate the exceedances of ecological risk screening levels for lead observed in the target area, or to conclude with certainty that no other MC are present at concentrations

that pose a potentially unacceptable risk. An expanded SI will be performed at UXO 2 to investigate the possible presence of buried caches of bullets near the firing lines and between the firing lines and the target area, as well as to investigate the lead exceedances and the potential presence of other MC. A preliminary assessment of ecological risk, as indicated by the exceedances of minimum ecological screening levels specified in the SI, was performed in response to USEPA Region 4 comments on the SI Report, dated August 22, 2011, which were appended to the draft version of this plan. The preliminary ERA is presented in [Appendix D](#). An ERA and HHRA will be performed for UXO 2 as part of the RI, if necessary, based on results of the risk screening evaluations to be conducted using the MC data collected during both the initial SI and Expanded SI.

The additional data collection activities planned for UXO 2 are described in detail in the Expanded SI Work Plan, which has been submitted under separate cover. Also included in that plan are data collection activities for the UXO 4 Rocket Range Subarea, which was recently discovered in the uprange portion of the UXO 4 firing fan.

3.0 REMEDIAL INVESTIGATION

The RI for UXO Sites 2 to 8 is being conducted in two stages. The first stage, which is the subject of Part 1 of the SAP (a.k.a. the MEC SAP), consists of an MEC investigation of UXO Sites 3 to 8 that includes detector-aided surface surveys, land-based geophysical surveys, intrusive investigations of subsurface anomalies, and aquatic investigations of underwater anomalies, as well as explosive safety HAs, as necessary, for each site. The second stage, which is the subject of Part 2 of the SAP (a.k.a. the MC SAP), consists of an MC investigation that includes sampling and analysis of soil, sediment, and groundwater for UXO Sites 3 to 8, as well as human health and ecological risk evaluations for UXO Sites 2 to 8. The two investigative stages are intended to be conducted interactively because the highest concentrations of MC at UXO Sites 3 to 8 are expected to be found in environmental media located directly beneath or adjacent to MEC and MPPEH. Thus, results of the investigation conducted under the MEC SAP (i.e., the identification of locations where MEC or MPPEH exists) will be used to identify biased locations for sample collection and analysis under the MC SAP, as necessary, to fulfill the project objectives.

Data obtained under this RIWP will be used to establish the nature and extent of MEC/MPPEH and MC contamination associated with the historical use of munitions at each of the UXO sites. The investigative approaches are designed to provide for the collection of sufficient site-specific data to evaluate risk and, if necessary, develop remedial alternatives. The RI field activities outlined in this RIWP are generally similar to those conducted during the SI, although the scope has been expanded as follows:

MEC investigation – Includes surveys of additional areas within and/or adjacent to the previously defined site boundaries; removal of surficial metallic items from certain areas prior to survey to reduce electronic clutter that may interfere with the subsurface geophysical investigation; and intrusive and aquatic investigations of subsurface and underwater anomalies at select locations to delineate the horizontal and vertical extent of MEC/MPPEH. If sufficient evidence of MEC/MPPEH is documented during the field investigation, an explosives safety HA will be performed so that explosion risks can be accurately assessed and, if necessary, remedial alternatives for mitigating these risks can be evaluated in a Feasibility Study (FS).

MC investigation – Includes the collection and analysis of samples from additional sites not previously sampled (e.g., UXO 3, UXO 7, and UXO 8); from additional areas within previously sampled sites (UXO 4, UXO 5, and UXO 6); from additional environmental media not previously sampled (e.g., groundwater, subsurface soil); and for additional MC not previously analyzed (e.g., metals other than lead). Sample locations will be biased toward environmental media in the immediate vicinity of MEC/MPPEH items identified during the MEC investigation, and samples will be analyzed for area- or site-specific chemicals of potential concern (COPCs). In some cases, supplemental analyses may be included to more completely characterize contaminant concentrations, migration potential, and/or bioavailability at a particular site. If the resulting analytical data indicate the presence of MC at potentially unacceptable concentrations, an HHRA and/or ERA will be performed, as appropriate. If risks are unacceptable, the risk estimates will be available for subsequent use in an FS designed to evaluate options for mitigating the risks.

Following are descriptions of each UXO site subject to additional data collection under this RIWP, along with a summary of the planned field investigation activities. Activities are described in terms of the MEC SAP (Part 1 of the SAP) and the MC SAP (Part 2 of the SAP).

3.1 Aerial Bombing Target at Parade Deck (UXO 3)

This former bombing target was known to be on the Parade Deck as early as 1937. Miniature practice bombs are reported to have been the munitions used at this site. The bombing target consisted of concentric circles outlined on the ground that would have been visible from the air. Target use ceased with paving of the parade field, which was completed in the early 1940s. Additional paved parking lots and buildings have been built in this area since the time of active target use.

Under the MEC SAP, a statistically significant subset of anomalies identified during the SI will be investigated through intrusive means (i.e., reacquisition of anomalies followed by detector-aided hand-digging and, if necessary, mechanized low input operations) to determine whether, and to what extent, MEC/MPPEH items are present beneath the surface. In addition, step-out geophysical surveys and

intrusive investigations will be conducted, if necessary, to delineate the spatial boundaries of MEC/MPPEH contamination.

Under the MC SAP, soil samples will be collected at 12 locations, and groundwater samples will be collected at three temporary well locations to identify environmental media that may be impacted with MC as a result of historical site operations. Soil samples from each location will be analyzed for metals; aliquots of soil from each location will be combined into surface and subsurface soil composite samples and analyzed for explosives; and groundwater samples will be analyzed for metals and explosives. Surface soil samples will also be analyzed for pH for use in the ERA.

3.2 Field Artillery West Main Range (UXO 4)

This range is one of two field artillery firing ranges established in 1937. Munitions use at UXO 4 included artillery ammunition for 75-millimeter (mm) guns and howitzers, M1897 and M1, respectively, including both High Explosives (HE) and shrapnel munitions.

Under the MEC SAP, additional land-based surface and geophysical surveys will be conducted in transects over accessible portions of the impact area that have not been previously surveyed, and a subset of the land-based anomalies identified during either the previous SI or this RI will be investigated through intrusive means to determine the extent to which MEC/MPPEH are present at the site. Approximately ten 50-foot by 50-foot grids will be subject to 100% geophysical survey and intrusive investigation to collect data regarding localized MEC/MPPEH distribution within the impacted regions. Geophysical surveys will be conducted at the firing points where land-based surface surveys were conducted during the SI, and any anomalies detected at these locations will be intrusively investigated. Aquatic investigations of the waterways will be performed to determine the extent to which geophysical anomalies indicate the presence of underwater MEC/MPPEH. Step-out geophysical surveys and additional intrusive investigations will also be conducted, as necessary, to delineate the spatial boundaries of MEC/MPPEH contamination.

Under the MC SAP, biased soil samples will be collected at 12 to 15 locations within the impact area and up to 12 locations near the firing points, at discretionary locations (i.e., where site-related munitions items are identified during the intrusive MEC investigation). Up to three 50-point incremental sampling (IS) samples will be collected from survey grids where evidence of low-order detonation is discovered during the MEC investigation. Soil samples will also be collected at 12 systematic locations near Firing Point C to investigate the exceedance of a risk-based screening value for lead observed identified in the surface soil during the SI. Groundwater samples will be collected at six temporary well locations situated along the impact area boundaries. Sediment samples will be collected at up to ten discretionary locations where surface runoff from areas containing surficial MEC/MPPEH may be entering adjacent waterways.

If any MEC/MPPEH items are identified in the submerged sediments within the waterways, biased samples will be collected at up to ten discretionary sediment locations. The impact area soil, sediment, and groundwater samples will be analyzed for metals and explosives, the Firing Point soil samples will be analyzed for metals, and the IS samples will be analyzed for explosives. Surface soil samples will also be analyzed for pH, and sediment samples will be analyzed for pH and Total Organic Carbon (TOC) for use in the ERA.

3.3 Field Artillery East Shrapnel Range (UXO 5 and UXO 6)

The second of the two impact areas established in 1937 is the Field Artillery East Shrapnel Range. UXO 5 contains the firing point for this range, and UXO 6 contains the impact area. Types of munitions used at this range consisted of 75-mm shrapnel munitions.

Under the MEC SAP, surface and geophysical surveys will be conducted at the UXO 5 firing point, and any anomalies detected will be intrusively investigated. At UXO 6, surface and geophysical surveys followed by intrusive investigation will be performed along transects in the land area adjacent to the western boundary of the marsh and in the land area nearest to the aquatic anomalies identified in the southwest portion of the site during the SI. Due to the inaccessibility of the vast majority of this site, no other land surveys will be conducted. If any land-based anomalies are identified during the RI, a subset will be investigated through intrusive means to determine the extent to which MEC/MPPEH are present. Approximately three 50-foot by 50-foot grids will be subject to 100% geophysical survey and intrusive investigation to collect data regarding localized MEC/MPPEH distribution within the impacted regions. Aquatic investigations of the waterways will be performed to determine the extent to which geophysical anomalies may indicate the presence of underwater MEC/MPPEH. Step-out geophysical surveys and additional intrusive investigations will also be conducted, as necessary, to delineate the spatial boundaries of MEC/MPPEH contamination.

Under the MC SAP at UXO 5, one 50-point composite (i.e., "incremental") surface soil sample will be collected and analyzed for explosives, and up to 12 discrete biased soil samples will be collected at discretionary locations (only if site-related munitions items are identified during the intrusive MEC investigation). The biased samples will be analyzed for metals.

Under the MC SAP at UXO 6, discretionary surface soil, subsurface soil, sediment, and submerged sediment samples may be collected, if warranted, based on results of the MEC investigation. If any site-related MEC/MPPEH items are identified during the intrusive MEC investigation along the western boundary of the site, biased soil samples will be collected at up to 12 discretionary locations. Up to three 50-point IS samples will be collected from survey grids where evidence of low-order detonation is discovered during the MEC investigation. Sediment samples will be collected at up to ten discretionary

locations where surface runoff from areas containing surficial MEC/MPPEH may be entering adjacent waterways. If any MEC/MPPEH items are identified in the submerged sediments within the waterways, biased samples will be collected at up to ten discretionary sediment locations. Discrete soil and sediment samples will be analyzed for metals and explosives, and the IS samples will be analyzed for explosives. Surface soil samples will also be analyzed for pH, and sediment samples will be analyzed for pH and TOC for use in the ERA.

3.4 Aerial Bombing Target at Golf Course (UXO 7)

This former bombing target was established as a replacement for the Aerial Bombing Target at Page Field in 1942. Miniature practice bombs were used at the Aerial Bombing Target at Golf Course; however, use of this target is thought to have ceased in July 1946, and a golf course was completed over it by 1948. The former target center was located on the green of what was once the eighth hole, but is now part of the driving range.

Under the MEC SAP, additional land-based surface and geophysical surveys will be conducted in areas adjacent to the site, which were not previously surveyed. A subset of anomalies identified during either the previous SI or this RI will be investigated through intrusive means to determine whether, and to what extent, MEC/MPPEH items are present. Approximately five 50-foot by 50-foot grids will be subject to 100% geophysical survey and intrusive investigation to collect data regarding localized MEC/MPPEH distribution within the impacted regions. In addition, step-out geophysical surveys and additional intrusive investigations will be conducted, as necessary, to delineate the spatial boundaries of MEC/MPPEH contamination.

Under the MC SAP, soil samples will be collected at 12 to 15 locations, and groundwater samples will be collected at three temporary well locations to identify environmental media that may be contaminated with MC as a result of historical site operations. Soil samples from each location will be analyzed for metals; aliquots of soil from each location will be combined into surface and subsurface soil composite samples and analyzed for explosives; and groundwater samples will be analyzed for metals and explosives. Surface soil samples will also be analyzed for pH for use in the ERA.

3.5 Aerial Bombing Target at Southern Tidal Flats (UXO 8)

This former bombing target was located on the tidal flats south of the golf course. Presumably, the time frame of range use spanned World War II, although the target is barely discernable on 1945 aerial imagery. Two ten-foot tall metal posts, which formed the target's center; and other rusty sheet metal debris apparently derived from 100-pound practice bombs have been observed.

Under the MEC SAP, additional land-based surface and geophysical surveys will be conducted in transects over portions of the site that were previously surveyed, as well as in areas adjacent to the site, which were not previously surveyed. To eliminate the electronic “clutter” that interferes with the interpretation of survey results, surface metal debris will be removed from the transect areas prior to conducting the surveys. A subset of anomalies identified during this RI will be investigated through intrusive means to determine whether, and to what extent, MECMPPEH items are present beneath the surface. Approximately eight 50-foot by 50-foot grids will be subject to 100% geophysical survey and intrusive investigation to collect data regarding localized MEC/MPPEH distribution within the impacted regions. In addition, step-out geophysical surveys and additional intrusive investigations will be conducted, as necessary, to delineate the spatial boundaries of MEC/MPPEH contamination.

Under the MC SAP, sediment samples will be collected at 12 locations distributed across the site. Precise locations will be selected in the field to coincide with surface debris accumulations located closest to predetermined default locations. No soil or groundwater sampling will be conducted because the site lies within a tidal flat area that is completely submerged during high tide. Sediment samples from each location will be analyzed for metals; and aliquots of sediment from each location will be combined into shallow surface and deep surface sediment composite samples and analyzed for explosives. Sediment samples from each location will also be analyzed for pH and TOC for use in the ERA.

4.0 EXPLOSIVES SAFETY SUBMISSION

The Explosives Safety Submission (ESS) governing the implementation of this plan is presented in [Appendix A of the MEC SAP](#). This ESS was submitted to and approved by the Commander, Marine Corps Systems Command (COMMARCORSYSCOM), Program Manager of Ammunition (PM Ammo), and Department of Defense Explosive Safety Board (DDESB) prior to commencement of fieldwork.

TABLES

TABLE INT-1

SI FIELD WORK SCOPE SUMMARY
MCRD PARRIS ISLAND, SOUTH CAROLINA
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Site	MEC Investigation			MC Sampling	
	Detector-Aided Surface Survey	Geophysics Survey of Subsurface		Surface Soil	Sediment
		Land-Based	Aquatic		
UXO 1 – Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area ⁽¹⁾	--	--	--	--	--
UXO 2 - Rifle Range at Ballast Creek	--	--	--	Inside the treeline, just north of the concrete target foundations; grab samples 0 to 12 inches bgs for lead analysis.	Areas surrounding the concrete target foundations; grab samples 0 to 6 and 24 to 36 inches bgs for lead analysis.
UXO 3 - Aerial Bombing Target at Parade Deck	--	Grassy area north of the center of the target	--	--	--
UXO 4 - Field Artillery West Main Range	Select portions of the impact area and 100-foot radius around firing points	Select portions of the impact area	Accessible waterways within impact area	Firing Points: Grab samples 0 to 12 inches bgs for lead analysis, incremental samples 0 to 6 inches bgs for explosives ⁽²⁾ analysis. Select Portions of the Impact Area: XRF screening 0 to 12 inches bgs, grab samples 0 to 12 inches bgs for lead analysis, incremental samples 0 to 6 inches bgs for explosives ⁽²⁾ analysis.	Select Portions of Impact Area: XRF screening 0 to 6 inches bgs, grab samples 0 to 6 inches bgs for lead analysis. Waterways: Grab samples top 6 inches of submerged sediment for lead and explosives ⁽²⁾ analysis.

TABLE INT-1

SI FIELD WORK SCOPE SUMMARY
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 2 of 2

Site	MEC Investigation			MC Sampling	
	Detector-Aided Surface Survey	Geophysics Survey of Subsurface		Surface Soil	Sediment
		Land-Based	Aquatic		
UXO 5 - Field Artillery East Shrapnel Range, Firing Point	Firing point	--	--	Grab samples 0 to 12 inches bgs for lead analysis, incremental sample 0 to 6 inches bgs for explosives ⁽²⁾ analysis.	--
UXO 6 - Field Artillery East Shrapnel Range, Impact Area	Small area along the western boundary of impact area	--	Accessible waterways within impact area	--	Small area along the western boundary of impact area: grab samples 0 to 6 and 24 to 36 inches bgs for lead and explosives ⁽²⁾ analysis. Waterways: Grab samples top 6 inches of submerged sediment for lead and explosives ⁽²⁾ analysis.
UXO 7 - Aerial Bombing Target at Golf Course	Target center and areas to the east and west of target	Target center and areas to the east and west of target	--	--	--
UXO 8 - Aerial Bombing Target at Southern Tidal Flats	Target center and area to the south-southeast of target	Target center and area to the south-southeast of target	--	--	--

-- = Not Performed

(1) Field investigation and sampling were not conducted at UXO 1 during the SI; only a document review was conducted.

(2) Explosives analysis included: 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; 2-amino-4,6-dinitrotoluene; 2-nitrotoluene; 3-nitrotoluene; 4-amino-2,6-dinitrotoluene; 4-nitrotoluene; HMX; nitrobenzene; RDX; and tetryl. Propellants that may have been constituents of munitions used at UXOs 4, 5, and 6 are included in this list.

TABLE INT-2

SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
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Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 1 – Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area (document review only)	NA	NA	NA	None.	No field data has been collected to confirm the assumption that no grenade range existed at this location.	Expand the SI to include detector-aided surveys to determine whether physical evidence of grenade use exists at this location. Include biased MC sampling if evidence of grenade use is discovered.
UXO 2 – Rifle Range at Ballast Creek,	NA	NA	No exceedances of human health screening levels for lead contamination in sediment or surface soil, but a few exceedances of ecological screening levels.	As expected, no significant lead contamination found, although a potential exists for unacceptable ecological risk.	It is uncertain whether lead concentrations in surface soil and sediment would cause an unacceptable ecological risk or whether additional MC constituents may be present at concentrations that may pose either a human health or ecological risk. It is uncertain whether caches of bullets may exist near the firing line or in the wooded area between the firing line and concrete target foundations.	Expand the SI to include collection of additional soil and sediment samples to assess potential impacts from MC metals and to delineate the extent of contamination near the concrete target foundations. Include soil sampling at the firing lines to determine whether nitroglycerin may be present. As part of the Expanded SI, conduct detector-aided surface surveys at firing lines and in the wooded area between the firing line and concrete target foundations to determine whether caches of bullets are present.

TABLE INT-2

**SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
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Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 3 – Aerial Bombing Target at Parade Deck	No surface munitions items expected or encountered.	Numerous subsurface anomalies detected, which may or may not be related to practice bomb use.	NA	As expected, no surface munitions items are present. However, more subsurface anomalies were detected than expected. The presence of MEC remains suspect.	Subsurface anomalies identified within the grassy area to the north of the target center cannot be resolved without intrusive investigation. In places where anomalies are densely distributed, the resulting electronic clutter may mask underlying MEC/MPPEH items. It is uncertain whether anomalies exist in the non-surveyed areas, including the inaccessible areas beneath the pavement. The Partnering Team has requested MC sampling to evaluate chemical contaminants (metals and explosives) in soil and groundwater.	Proceed to RI and conduct additional geophysical subsurface surveys; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in soil and groundwater.

TABLE INT-2

SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
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Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 4 – Field Artillery West Main Range	75-mm HE and shrapnel components and other munitions-related items identified on surface in impact area. No surface munitions items identified at firing points.	Numerous subsurface anomalies detected on land and within waterways, which may or may not be related to artillery range use.	No explosive compounds detected in soil or sediment. A few soil samples contained lead concentrations higher than ecological screening levels.	MEC presence was suspected and confirmed during SI. Lead contamination was noted at Firing Point C and at a few locations in the impact area.	Not all accessible areas within the firing fan and impact area boundaries were investigated during the SI, nor were inaccessible areas investigated. Detection depths achieved during surveying were not to the theoretical maximum penetration depth for munitions used at this site (land and aquatic). Lead contamination at Firing Point C was not spatially bounded. Additional data is needed to quantify MC concentrations (including metals and explosives) in soil, sediment, and groundwater due to MEC presence. Subsurface anomalies cannot be resolved without intrusive investigation. Aquatic anomalies require investigation. Partnering Team has requested geophysical surveys and intrusive investigations at all firing point locations.	Proceed to RI and conduct additional detector-aided surface and subsurface geophysical surveys within the impact area and at the firing points, as appropriate; intrusive investigation of select SI and RI anomalies; underwater imaging of aquatic anomalies; and MC sampling for metals and explosives in soil, sediment, and groundwater..

TABLE INT-2

**SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
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Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 5 – Field Artillery East Shrapnel Range, Firing Point	No surface munitions items encountered.	NA	No significant chemical contamination (although MDLs for some explosives compounds did not meet minimum ecological screening levels).	As expected, no surface munitions items are present. The presence of subsurface MEC remains suspect.	Due to lack of historical documentation regarding the precise location of Firing Point T and lack of physical evidence recovered during the SI, it is uncertain whether the presumed firing point location is correct. Not all accessible and inaccessible areas within range fan were investigated during SI, including the waterway that traverses the site. Partnering Team has requested geophysical surveys and intrusive investigation of all firing point locations.	Proceed to RI and conduct detector-aided surface and subsurface geophysical surveys at the revised firing point location; intrusive investigation of select anomalies (if identified); and MC sampling for metals and explosives in soil.

TABLE INT-2

SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 5 OF 7

Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 6 – Field Artillery East Shrapnel Range, Impact Area	No surface munitions items encountered.	Numerous anomalies detected in waterways, which may or may not be related to artillery range use.	No significant chemical contamination (although MDLs for some explosives compounds did not meet minimum ecological screening levels).	No surface munitions items are present. The presence of subsurface and underwater MEC remains suspect.	Most areas within the firing fan and impact area consist of marshland that is not accessible and was not investigated during the SI. Small land masses on western perimeter were investigated to confirm clean boundaries of contamination. Aquatic anomalies require investigation. Detection depths achieved during surveying were not to the theoretical maximum penetration depth for munitions used at this site (land and aquatic). Additional data is needed to quantify MC concentrations (including metals and explosives) in soil and sediment due to potential MEC presence.	Proceed to RI and conduct additional detector-aided surface and subsurface geophysical surveys within the impact area; intrusive investigation of select SI and RI anomalies; underwater imaging of aquatic anomalies; and MC sampling for metals and explosives in soil and sediment.

TABLE INT-2

SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 6 OF 7

Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 7 – Aerial Bombing Target at Golf Course	No range-related munitions items encountered; however, other munitions items (assumed to be MDAS) were found at northern edge of survey area.	Numerous subsurface anomalies detected, which may or may not be related to practice bomb use.	NA	As expected, no surface munitions items are present on golf course fairway. However, more subsurface anomalies were detected than expected. The presence of MEC remains suspect.	Subsurface anomalies cannot be resolved without intrusive investigation. Detection depths achieved during surveying may not have been sufficient to detect buried MEC/MPPEH items in places where fill material is present. It is uncertain whether anomalies exist in areas outside of the SI survey areas. Partnering Team has requested MC sampling to evaluate chemical contaminants (metals and explosives) in soil and groundwater, and investigation below the native soil/fill horizon.	Proceed to RI and conduct additional detector-aided surface and subsurface geophysical surveys in areas north and south of the original target area; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in soil and groundwater.

TABLE INT-2

**SI RESULTS, DATA GAPS, AND RECOMMENDATIONS
MCRD PARRIS ISLAND, SOUTH CAROLINA
PAGE 7 OF 7**

Site Name	SI MEC Results		SI MC Results ⁽²⁾	Changes to CSM	SI Data Gaps	Recommendations ⁽³⁾
	Surface MEC	Subsurface MEC ⁽¹⁾				
UXO 8 – Aerial Bombing Target at Southern Tidal Flats	No MEC encountered; however, large quantities of practice bombs and practice bomb fragments (assumed to be MDAS) were observed on surface.	Numerous subsurface anomalies detected, which are likely related to practice bomb use.	NA	Surface debris was more extensive than anticipated. More subsurface anomalies were detected than expected. The presence of MEC remains suspect.	Additional areas require survey where practice bomb fragments are present. Surface debris must be removed prior to survey to reduce electronic clutter. Subsurface anomalies cannot be resolved without intrusive investigation. Detection depths achieved during surveying were not to the theoretical maximum penetration depth for munitions used at this site. Partnering Team has requested MC sampling (metals and explosives) to evaluate chemical contaminants in sediment.	Proceed to RI and conduct additional detector-aided surface and subsurface geophysical surveys after removing surface debris in previously surveyed areas and adjacent, expanded areas; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in sediment.

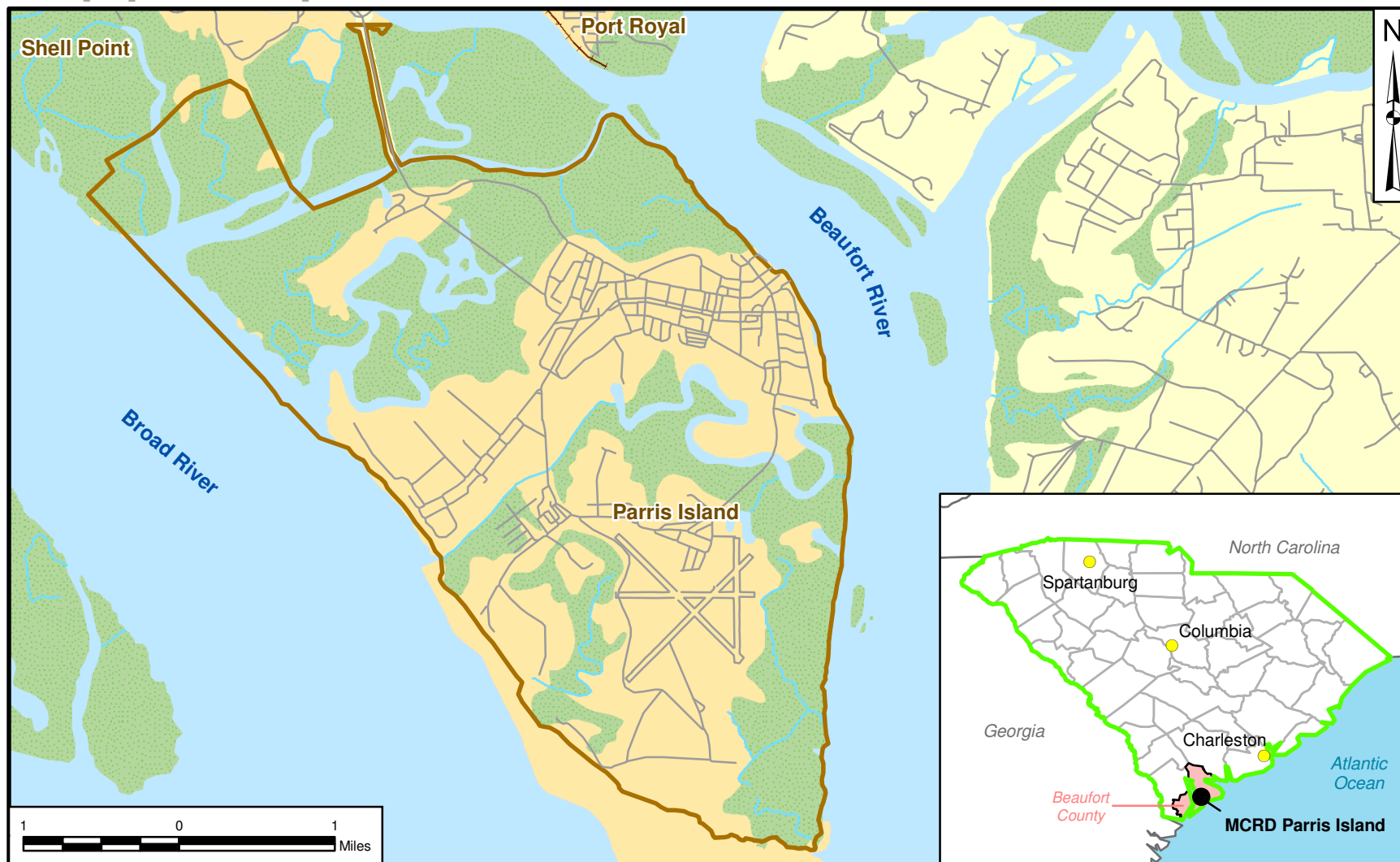
ASR = Archives Search Report
CSM = Conceptual Site Model
HE = High Explosive
MC = Munitions Constituents
MDAS = Material Documented as Safe
MDL = Method Detection Limit

MEC = Munitions and Explosives of Concern
NA = Not Applicable
RI = Remedial Investigation
RIPRA = Range Identification and Preliminary Range Assessment
SI = Site Investigation
UXO = Unexploded Ordnance

Notes:

- (1) No intrusive MEC investigation was performed during the SI, in accordance with the SI planning documents as restricted by Naval Ordnance Safety and Security Activity (NOSSA) during the SI phase of Navy munitions investigation projects.
- (2) Complete discussions of screening level exceedances, as applicable, are included in Sections 5.0 through 10.0 of SI Report (Tetra Tech, 2011).
- (3) Recommendations from the SI have been expanded to include revisions and details added during the RI planning process.

FIGURES



DRAWN BY	DATE
J. ENGLISH	12/08/08
CHECKED BY	DATE
B. BECKER	09/28/11
REVISED BY	DATE
SCALE AS NOTED	



FACILITY LOCATION MAP
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER CTO JM10	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. FIGURE INT-1	REV 0

Aerial photograph taken in 2008.



DRAWN BY	DATE
T. WHEATON	02/03/11
CHECKED BY	DATE
M. COFFMAN	12/09/11
REVISED BY	DATE
C. TULLEY	01/12/12
SCALE	
AS NOTED	



UXO SITE LOCATION MAP
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER 02296	CTO NUMBER JM10
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APPROVED BY —	DATE —
FIGURE NO. FIGURE INT-2	REV 0



DRAWN BY	DATE
T. WHEATON	02/03/11
CHECKED BY	DATE
B. BECKER	04/27/12
REVISED BY	DATE
MK BOND	04/27/12
SCALE	
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MCRD RANGES AND TRAINING AREAS
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	CTO NUMBER
02296	JM10
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
INT-3	0

APPENDIX A

GLOSSARY OF MEC-RELATED TERMS

(Excerpted from: NAVSEA OP-5, Appendix A [Definitions and Abbreviations])

APPENDIX A

DEFINITIONS AND ABBREVIATIONS

(AS PUBLISHED IN: NAVSEA OP 5, VOLUME 1, SEVENTH REVISION, CHANGE 10)

Ammunition - A device charged with explosives, propellants, pyrotechnics, initiating composition or chemical material for use in connection with defense or offense including demolitions, training, ceremonial, or non-operational purposes.

Anomaly Avoidance - Techniques employed by EOD- or UXO-qualified personnel at sites known or suspected to contain MEC in order to avoid contact with potential surface or subsurface explosive hazards. Anomaly avoidance often will be practiced in support of sampling well installation, surveying, site reconnaissance, etc. Intrusive anomaly investigation is not authorized during anomaly avoidance operations. Anomaly avoidance is sometimes referred to as UXO avoidance.

Armed - A fuze is considered armed when any firing stimulus can produce fuze function.

a. A fuze employing explosive train interruption is considered armed when the interrupters position is ineffective in preventing propagation of the explosive train at a rate equal to or exceeding 0.5 percent at a confidence level of 95 percent.

b. A fuze employing non-interrupted explosive train is considered armed when the stimulus available for delivery to the initiator equals or exceeds the initiator's maximum no-fire stimulus.

Authorized Visitor - Personnel conducting project- or mission-related functions that require them to be present in the EZ for a specific purpose and for a limited time.

Barricade - An intervening barrier, natural or artificial, of type, size, and construction intended to limit the effect of an explosion on nearby buildings or exposures.

Blank Ammunition - Ammunition that consists of a cartridge case with primer and powder charge but which does not contain a projectile. Blank ammunition is used for simulated fire, for signaling, and for training exercises.

Blast Impulse - The product of the overpressure from the blast wave of an explosion and the time during which it acts at a given point (that is, the area under the positive phase of the overpressure versus time curve).

Blast Overpressure - The pressure, exceeding the ambient pressure, manifested in the shock wave of an explosion.

Blasting Cap - Blasting caps are classified in accordance with the method of initiation. There are two types of blasting caps:

Breakdown - The separation of a complete round of ammunition or subassembly into its components or separate parts; the removal of one or more components from a round.

Burning - A chemical reaction in which the output of heat is sufficient to enable the reaction proceed and be accelerated without input of heat from another source. Burning is a surface phenomenon with the reaction products flowing away from the unreacted material along the surface at subsonic velocity. Confinement of the reaction increases pressure, rate of reaction and temperature, and may cause

transition into deflagration. If burning occurs within a munition, this is the least violent type of explosive event. The energetic material ignites and burns, non-propulsively. The case may open, melt or weaken sufficiently to rupture nonviolently, allowing mild release of combustion gases. Debris stays mainly within the area of the fire. debris is not expected to cause fatal wounds to personnel or be a hazardous fragment beyond 15 m.

Burning Area - The site at which ammunition and explosives are disposed of by burning.

Carrier, common (commercial) - A company engaged in the business of transporting persons or property for compensation and for all persons impartially.

Cartridge - A complete round of ammunition in which the primer, propelling charge and projectile or bullet are completely assembled to the cartridge case as fixed ammunition; or the primer and the propelling charge are assembled in the cartridge case and closed by a friable plug.

Certification (Personnel) - A formal, documented declaration that an individual, by virtue of management review, has met all of the qualification requirements established to perform a task.

Certification of MPPEH - Signed documentation that declares the explosives safety status of MPPEH.

Chain of Custody - The activities and procedures taken throughout the inspection, re-inspection and documentation process to maintain positive control of MPPEH to ensure the veracity of the process used to determine the status of material as to its explosive hazard. This includes all such activities from the time of collection through final disposition.

Charge - The quantity of explosive used in a munition or component thereof. The charge is usually confined by a case, but when no confinement is used, it is usually called a bare charge.

Complete Round - A term applied to an assemblage of explosive and nonexplosive components designed to perform a specific function at the time and under the conditions desired.

Component - Any part of a complete round whether loaded with explosives or inert material, or empty.

Container - A general term that encompasses boxes; cartridge or powder tanks, cartons, drums, barrels, cylinders or cans; containers for long ordnance items; and cargo containers (Dromedaries, etc.) for shipments of sizeable quantities of hazardous materials. A pallet is not considered to be a container.

Demilitarization - The act of destroying the military offensive or defensive advantages inherent in certain types of equipment or material. The term includes mutilation, dumping at sea, cutting, crushing, scrapping, melting, burning or altering; designed to prevent the further use of this equipment and material for its originally intended military or lethal purpose. The term applies equally to material in unserviceable or serviceable condition, that has been screened through the Inventory Control Point (ICP) and declared surplus or foreign excess.

Demolition Area - An area specifically designated and reserved for destroying explosives and explosive-loaded devices.

Demolition Material - Explosives and accessories used for blasting, eliminating hazards to navigation and obstacles to amphibious landing, or for destroying equipment.

Department of Transportation (DOT) Regulations - Latest issue of regulations issued by the DOT for the transportation of ammunition, explosives, and other hazardous materials.

Detonation - A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. A detonation is a reaction which proceeds through the reacted material toward the unreacted material at a supersonic velocity (by a shock wave process). The result of the chemical

reaction is exertion of extremely high pressures on the surrounding medium forming a propagating shock wave which is originally of supersonic velocity. This is the most violent type of explosive event, whether occurring within a munition or in bulk material. A supersonic decomposition reaction propagates through the energetic material to produce an intense shock in the surrounding medium, air or water for example, and very rapid plastic deformation of metallic cases, followed by extensive fragmentation. All energetic material will be consumed. The effects will include large ground craters for munitions on or close to the ground, holing/plastic flow damage/fragmentation of adjacent metal plates, and blast overpressure damage to nearby structures.

Discarded Military Munitions (DMM) - Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

Disposal - End of life tasks or actions for residual materials resulting from demilitarization or disposition operations.

Disposition - The process of reusing, recycling, converting, redistributing, transferring, donating, selling, demilitarizing, treating, destroying, or fulfilling other life-cycle guidance, for DoD property.

DOT Class - A category of materials classified by DOT based on the character and predominance of the associated hazards and of the potential for causing personnel casualties or property damage. The hazard classes are Explosives A, B, and C; Blasting Agent; Flammable Liquid; Flammable Solid; Combustible Liquid; Flammable Gas; Nonflammable Gas; Oxidizer; Organic Peroxide; Corrosive Material; Poisons A and B; Irritating Material; Radioactive Material; Etiological Agent; ORM-A, ORM-B, ORM-C and ORM-D. Refer to Bureau of Explosives Tariff No. BOE-6000, [49 CFR 173](#) for definitions.

Empty Ammunition - An ammunition item or component that does not contain explosive material or inert material. Empty ammunition items and components include:

- a. Ammunition items or components that were manufactured empty or without the components that contain the explosive material.
- b. Ammunition items or components that have had their explosive material completely removed by disassembly, firing, thermal treatment or other means.

Engineering Controls - Regulation of facility operations through the use of prudent engineering principles; e.g., facility design, operational sequencing, equipment selection and process limitations.

Essential Personnel - Personnel whose duties require them to remain within an ESQD one or more of the following reasons:

- a. Direct involvement in an ammunition and explosives handling operation.
- b. Normal inport ship-keeping duties by assigned personnel.
- c. Provision of mission-required in-port services.
- d. Provision of mission-related repairs and/or tests to in port ships.
- e. Safe and efficient completion of the munitions response action.

Essential personnel do not include vendors, commercial delivery vehicles (unless carrying mission-related materials), dependents or non-DOD personnel except as categorized above.

Exclusion Zone (EZ) - An ESQD arc established around a munitions response work area where MEC procedures are being conducted. An EZ is created by a response operation that may move within defined boundaries, can be suspended, and will be cancelled upon project completion.

Explosion - A violent chemical reaction within a chemical compound or mixture or mechanical mixture evolving heat and pressure. An explosion is a reaction that proceeds through the reacted material toward the unreacted material at sonic velocity (by a shock wave process). The result of the chemical reaction is exertion of high pressure on the surrounding medium, forming a propagating shock wave. Ignition and rapid reaction of the confined energetic material builds up high local pressures leading to violent pressure rupturing of the confining structure. Metal cases are fragmented (brittle fracture) into large pieces that are often thrown long distances. Unreacted and/or burning energetic material is also thrown about. Fire and smoke hazards will exist. Air shocks are produced that can cause damage to nearby structures. The blast and high velocity fragments can cause minor ground craters and damage (breakup, tearing, gouging) to adjacent metal plates. Blast pressures are lower than for a detonation.

Explosion Hazard - The hazard resulting from the tendency of certain materials to detonate en masse or burn with violence, causing destruction and damage or propagating explosions from one explosive site to another by blast wave or flying fragments.

Explosive (or Explosive Substances) - A substance, or mixture of substances, which is capable, by chemical reaction, of producing gas at such a temperature, pressure and rate as to be capable of causing damage to the surroundings. This general term "explosive" thus includes all solid and liquid materials variously known as high-explosives, propellants and pyrotechnics. Fuel-air explosives and explosives composed of liquid fuels and oxidants are included, when included in munitions, even though the individual components may not be explosive. Included are pyrotechnic substances, even though some may not produce reaction gases.

Explosive Limit - The maximum quantity of explosives or ammunition permitted in a magazine, production building, or other specified site. Explosive limits are based on quantity-distance damage considerations and are expressed in net pounds of explosive, number of rounds or units, or other measuring units. Also called Explosive Quantity.

Explosive Material - Any chemical material with hazard producing characteristics that is loaded into ammunition and/or ammunition components. This includes (but is not limited to) explosives, propellants, white phosphorous, incendiary mixtures, pyrotechnic mixtures, tracer mix, toxic materials, and riot control agents.

Explosive Mishap - Includes all of the following occurrences, near-occurrences and/or circumstances:

Explosive Ordnance Disposal (EOD) - The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration.

Explosive Ordnance Disposal (EOD) Personnel - Military personnel who have graduated from the Naval School, Explosive Ordnance Disposal; are assigned to a military unit with a Service-defined EOD mission; and meet Service and assigned unit requirements to perform EOD duties. EOD personnel have received specialized training to address explosive and certain CA hazards during both peacetime and wartime. EOD personnel are trained and equipped to perform Render Safe Procedures (RSP) on nuclear, conventional munitions, and on improvised explosive devices.

Explosives Safety Distance - The prescribed minimum distance between the hazard class divisions and quantities (net weight) of explosives, and between such explosives and specified exposures (inhabited buildings, public highways, public railways, petroleum tanks, aircraft) affording an acceptable degree of protection and safety. See Quantity-Distance.

Explosives - The term "explosive" or "explosives" includes any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, detonation or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of high highly heated gases which exert pressures in the surrounding medium. The term applies to high explosives, propellants and pyrotechnics

that either detonate, deflagrate, burn vigorously, generate heat, light, smoke, or sound. Also see [High Explosive](#), and [Initiating Explosive](#).

Explosives Anchorage - An area of water specifically designated for loading and unloading vessels and for anchoring vessels carrying a cargo of ammunition and explosives.

Explosives Area - Any area of a shore establishment in which explosives or ammunition are manufactured, stored, processed, or otherwise handled.

Explosives (or Munitions) Emergency Response - An immediate response by explosives and munitions emergency response personnel to control, mitigate, or eliminate the actual or potential threat encountered during an explosives or munitions emergency. An explosives or munitions emergency response may include in-place render-safe procedures, treatment or destruction of the explosives or munitions or their transport to another location to be rendered safe, treated, or destroyed. Reasonable delay in the completion of an explosives or munitions emergency response, which a necessary, unforeseen or uncontrollable circumstance causes, does not terminate the explosives or munitions emergency. Explosives and munitions emergency responses can occur on either public or private lands and are not limited to responses at Resources Conservation and Recovery Act (RCRA) facilities. (40 Code of Federal Regulations [CFR] §260.10)

Explosives Safety - The summation of all actions conducted at DON activities, ashore, and afloat, designed to manage and control the risks and hazards inherent with ammunition and explosives operations. Explosives safety is the process used to prevent premature unintentional, or unauthorized initiation of explosives and devices containing explosives; and with minimizing the effects of explosions, combustion, toxicity, and any other deleterious effects. Explosives safety includes all mechanical, chemical, biological, electrical, and environmental hazards associated with explosives, hazards of electromagnetic radiation to ordnance, and combinations of the foregoing. Equipment, systems, or procedures and processes whose malfunction would hazard the safe manufacturing, handling, maintenance, storage, transfer, release, testing, delivery, firing, or disposal of explosives are also included.

Explosives Safety Quantity Distance (ESQD) Arcs - The prescribed minimum distance between sites storing or handling hazard Class 1 explosive material and specified exposures (i.e., inhabited buildings, public highways, public railways, other storage or handling facilities or ships, aircraft, etc.) to afford an acceptable degree of protection and safety to the specified exposure. The size of the ESQD arc is proportional to the NEW present.

Explosives Safety Status of MPPEH - SAFE means certified as not presenting an explosion hazard, and consequently safe for unrestricted transfer or release pending any further demilitarization requirements or trade security controls. Material that has been certified safe is no longer considered MPPEH provided the chain of custody remains intact. HAZARDOUS means certified as known or suspected to present an explosion hazard.

Fragmentation - The breaking up of the confining material of a chemical compound or mechanical mixture when an explosion takes place. Fragments may be complete items, subassemblies, pieces thereof, or pieces of equipment or buildings containing the items.

Fragment Distance - The limiting range of a majority of fragments generated by an explosion of ammunition. Fragment distances are normally distances for hazard Class 1, Division 2 items as prescribed in [NAVSEA SW020-AC-SAF-010](#).

Fragment Hazard - The hazard resulting from the tendency of certain heavily encased explosive materials to explode progressively - a round, a box, or possibly one pile or stow of projectiles or fixed ammunition at a time - causing damage and destruction or propagation of explosion from one explosive site to another by the ejection into space of a considerable number of fragments. A hazardous fragment is one having

an impact energy of 58 ft/lb or greater. An acceptable density of hazardous fragments is one or less per 600 square feet.

Fragmenting Military Munitions - These military munitions have cases that are designed to fragment (for example, naturally fragmenting warheads, continuous rod warheads, items with scored cases and military munitions that contain pre-formed fragments). See also [Sensitivity Group](#).

Hazard - Any condition which may cause an accident or contribute to the severity of an accident. For purposes of classification, four general types of hazards are recognized in connection with ammunition and explosives. These are mass-explosion hazard, mass fire hazard, non-mass-detonating (fragmenting) hazard, and moderate fire, no blast hazard.

Hazard Analysis - The logical, systematic examination of an item, process, condition, facility, or system to identify and analyze the probability, causes, and consequences of potential or real hazards.

Hazardous Fragment - A hazardous fragment is one having an impact energy of 58 ft/lb or greater.

Hazardous Fragment Density - A density of hazardous fragments exceeding one per 600 square feet.

High Explosive - A substance which, in its application as a primary explosive, booster or main charge, in warheads and other applications, is generally required to detonate. This material may also be used as an energetic ingredient in propellants, pyrotechnics or other applications. RDX, HMX and TNT are examples of high explosives.

Inert Ammunition - Ammunition and components that contain no explosive material. Inert ammunition and components include:

- a. Ammunition and components with all explosive material removed and replaced with inert material.
- b. Empty ammunition or components.
- c. Ammunition or components that were manufactured with inert material in place of all explosive material.

Inert Material - Nonhazardous materials such as sand, plaster, binders with salts or metals, or cement that is used in ammunition items or components to simulate explosive material.

Inhabited Building(s) - A building or structure, other than an operating building, occupied in whole or part as a habitation for human beings, or a building or structure where people are accustomed to assemble, such as a church, schoolhouse, railroad station and similar transportation facilities, store, theater, or factory both within and outside an establishment.

Inhabited Building Distance - The minimum distance permitted between an inhabited building and an ammunition or explosives location for the protection of administration, quarters, industrial and other similar areas within a naval shore establishment. Inhabited building distances shall be provided between ammunition or explosives locations and the boundary of a shore establishment of the nearest point beyond the boundary where such inhabited structures could be erected.

Intraline Distance - The distance to be maintained between any two operating buildings and sites within an operating line, at least one of which contains or is designed to contain explosives, except that the distance from a service magazine for the line to the nearest operating building shall be not less than the intraline distance required for the quantity of explosives contained in the service magazine.

K-Factor - The factor in the formulas $D=KW$ (English units) or $D=KQ$ (metric units) which is used in quantity-distance determinations. The K-factor is a constant and represents the degree of damage that is acceptable. Typical constants used in English units are 1.25, 4.5, 9, 11, 18, 24, 30, 40 and 50; the lower

figures indicating the acceptance of a greater amount of damage. The value of K in English units is approximately 2.5 times its value in metric units.

Land Use Control (LUC) - A physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property, to manage risks to human health and the environment. Physical mechanisms encompass a variety of engineered remedies to contain or reduce contamination and/or physical barriers to limit access to real property, such as fences or signs.

Magazine – Any building or structure, except an operating building, used for the storage of ammunition and explosives.

Material Documented as an Explosive Hazard (MDEH) - MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

Material Documented as Safe (MDAS) - MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPEH.

Material Potentially Presenting an Explosive Hazard (MPPEH) - Material owned or controlled by the Department of Defense that, prior to determination of its explosives safety status, potentially contains explosives or munitions (for example, munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (for example, equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations). Excluded from MPPEH are military munitions within the Department of Defense's established munitions management system and other hazardous items that may present explosion hazards (such as gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

Maximum Fragment Distance - The calculated maximum distance to which any fragment from the cylindrical portion of an ammunition and explosives case is expected to be thrown by the design mode detonation of a single ammunition and explosives item. This distance does not address fragments produced by sections of nose plugs, base plates, boattails, and/or lugs. These special fragments, from the non-cylindrical portions of the ammunition and explosives case, can travel to significantly greater distances (that is, less than 10,000 feet (3048 meters)) than the calculated maximum distances. The maximum fragment distance may also be the measured distance, based on testing, to which any fragment from an ammunition and explosives item is thrown.

Military Munitions - All ammunition products and components produced or used by or for the U.S. Department of Defense or the U.S. Armed Services for national defense and security, including military munitions under the control of the Department of Defense, the U.S. Coast Guard, the U.S. Department of Energy, and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DOD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. Military munitions do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear components of nuclear devices, managed under DOE's nuclear weapons program, after all required sanitizing operations under the Atomic Energy Act of 1954, as amended, have been completed. See [40 CFR 260.10](#).

Munition - An assembled ordnance item that contains explosive material(s) and is configured to accomplish its intended mission.

Munition with the Greatest Fragmentation Distance (MGFD) - The munition with the greatest fragment distance that is reasonably expected (based on research or characterization) to be encountered in any particular area.

Munitions and Explosives of Concern (MEC) - Distinguishes specific categories of military munitions that may pose unique explosives safety hazard/risks and means UXO, DMM or MC's (such as TNT, RDX) present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) - Any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710(e)(4))

Munitions Debris - Remnants of munitions (such as fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions Response - Response actions, including investigation, removal actions and remedial actions to address the explosives safety hazards and human health or environmental risks presented by UXO, DMM, or MC.

Munitions Response Area (MRA) - Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges, munitions burial areas, and explosive processing facilities. A munitions response area is comprised of one or more munitions response sites.

Munitions Response Site (MRS) - A discrete location within a MRA that is known to require a munitions response.

NEW - Net Explosive Weight (in pounds). The actual weight of explosive mixture or compound including the TNT equivalent of other energetic material which is used in the determination of explosive limits and ESQD arcs.

Operational Range - A range that is under the jurisdiction, custody, or control of the Secretary of Defense and is used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. The term "range" when used in the geographical sense, means a designated land or water area that is set aside, managed and used for range activities of the Department of Defense. This term includes the following: firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas; and airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration.

Ordnance - Military materiel such as combat weapons of all kinds with ammunition and equipment required for their use. Ordnance includes all the things that make up a ship's or aircraft's armament - guns, ammunition, and all equipment needed to control, operate, and support the weapons.

Partial Detonation - Instances when only part of the total explosive load in ammunition detonates. Strong air shock and small as well as large case fragments are produced. Small fragments are similar to those in normal complete detonation. Extensive blast and fragmentation damage results to the surrounding area. Amount of damage and extent of breakup of cases into small fragments increases with increasing amount of explosive that detonates. Severity of blast could cause large ground crater, if ammunition is large bomb; hole size depends on amount of explosive that detonates.

Portable Magazine - Commercially built, pre-engineered magazines frequently used as read-service lockers. While their design suggests easy relocation, these magazines are covered by all safety and siting criteria applicable to any permanently constructed magazine.

Practice Ammunition - Ammunition specifically designed or modified for use in exercises, practice or operational training. Practice ammunition may be either expendable or recoverable. Practice ammunition is not inert and may contain all the explosive material normally contained in service ammunition. Practice ammunition may contain additional explosive material such as pyrotechnics, spotting charges or flotation devices to assure destruction, location or recovery.

Primary Explosive - Sensitive material used to initiate chemical reaction in booster explosives or as an initiation or ignition source for squibs and ignites used with propelling and pyrotechnic devices. Primary explosives are sensitive to heat, impact and shock and in warheads, are separated from the booster by the interruption of the fuze, exploder, or safe-and-arm device. Lead Styphnate and DXN-1 are examples of an approved primary explosive. Lead Azide, Mercury Fulminate are examples of restricted or obsolete primary explosives.

Primer - The primer is a mechanically or electrically initiated device, as originally used in military fuse trains, to initiate another explosive charge or the next element in the explosive train. Primers are more brisant than squibs and are of lower power than detonators.

Projectile - An object projected by an applied exterior force and continuing in motion by virtue of its own inertia, as a bullet, bomb, shell or grenade. Also applied to rockets and to guided missiles.

Propellant - Substances or mixtures of substances used for propelling projectiles and missiles, or to generate gases for powering auxiliary devices. When ignited, propellants burn at a controlled rate to produce quantities of gas capable of performing work but they must be capable of functioning in their application without undergoing a deflagration-to-detonation transition. (DDT).

Public Traffic Route - Any public street, road, highway, navigable stream, or passenger railroad (includes roads on a military reservation that are used routinely by the general public for through traffic).

Quality Assurance (QA) - An integrated system of management activities involving planning, implementing, assessing, reporting, and quality improvement to ensure a process, item, or service is of the type and quality needed to meet project requirements. (U.S. Army Corps of Engineers Engineering Pamphlet [EP] 1110-1-18)

Quality Control (QC) - The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements. (EP 1110-1-18)

Quantity-Distance - The quantity of explosives material and distance separation relationships which provide defined types of protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate quantity-distance tables. Separation distances are not absolute safe distances but are relative protective or safe distances. Distances greater than those shown in the table should be used wherever practicable.

Qualifications - A documented list of requirements an individual must satisfy prior to being certified; i.e., testing, formal classes, licenses, documented on-the-job training and experience, demonstrated task proficiency, physical, etc.

Range Activities - Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems. (10 U.S.C. 101(e)(2)(A) and (B))

Range-Related Debris - Debris, other than munitions debris, collected from operational ranges or from former ranges (such as, targets).

Remediation - The removal of pollutants or contaminants from environmental media such as soil, sediments, or water.

Safety Distances - Safety distances are empirical distances in relation to quantities of explosives and are the minimum permitted for separation of facilities within a hazard area of possible explosions and for separations of the explosive hazard from inhabited buildings, passenger railroads, and public highways in order to control the magnitude of damage, loss of life, and serious injuries. Separation distances are not absolute safe distances but are relative protective or safe distances and must be graduated as to risk to provide for selected types of protection. See also Quantity-Distance.

Secondary Explosives - Secondary explosives are generally less sensitive to initiation than primary explosives and are typically used in booster and main charge applications. A severe shock is usually required to trigger a reaction.

Small Arms Ammunition - Ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or smaller, or for shotguns. Small Arms Range - A range that has been used exclusively for the expenditure of small arms ammunition.

Standard Operating Procedure - A document which prescribes operator instructions in a definite course of action for processing a work unit. It is a tool for managing resources through planning and scheduling manpower, equipment, facilities and material in producing a quality product safely and efficiently. An SOP includes specifications, safety instructions and performance standards.

Unexploded Ordnance (UXO) - Military munitions that (a) have been primed, fused, armed, or otherwise prepared for action; (b) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or materiel; and (c) remain unexploded either by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5)(A) through (C))

UXO-Qualified Personnel - Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

UXO Technicians - Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

APPENDIX B
RESPONSES TO COMMENTS

APPENDIX B-1

**RESPONSES TO COMMENTS ON
SAMPLING AND ANALYSIS PLAN
MUNITIONS RESPONSE PROGRAM
UNEXPLODED ORDNANCE SITES 2, 3, 4, 5, 6, 7, 8
MCRD PARRIS ISLAND (TETRA TECH, SEPTEMBER 2011)**

RESPONSE TO SCDHEC COMMENTS DATED NOVEMBER 17, 2011

DRAFT SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM REMEDIAL INVESTIGATION AT UXO SITES 2 THROUGH 8

Meredith Amick, P.E., Environmental Engineer
Corrective Action Engineering Section
Division of Waste Management

COMMENTS

1. **Comment:** As described in previous comments further information is needed to concur with the No Further Action recommendation for UXO 1.

Response: The SI Report change pages containing additional information regarding UXO 1 were inadvertently omitted from the RI SAP (Part 0 – Introduction, Appendix A). These have been sent to the Team under separate cover (see email from P. Churchill, dated 12/06/11). (See response to EPA Comment 7 for additional information.)

2. **Comment:** Several different projects are mentioned for construction on UXOs 3-8. Please notify the Partnering Team of any construction prior to initiation per the “dig permit process” that the team is working on developing. Contractors should be notified of potential UXO and proper precautions should be taken. If any MEC are found during site work the Partnering Team should be notified.

Response: The Partnering Team will be notified of future construction events that are planned within the current UXO site boundaries and of any MEC discovered during construction activities.

3. **Comment:** Per the munitions rule active ranges do not require investigation until they are deemed other than operational. Therefore, active ranges should be carved out of MRP Site boundaries. Please make appropriate changes to maps and text.

Response: Figure INT-2 shows the active ranges that overlap or border the UXO 1 through 8 site boundaries. The text accompanying this figure in the RIWP Introduction (Munitions Response Program section) has been revised to clarify that the active ranges are not considered part of the current UXO investigation areas and that they will be investigated at a later date following permanent termination of firing activities. In addition, a new figure (Figure INT-3) and accompanying table (Table INT-3) have been added to show the locations of all ranges identified in the Range Identification and Preliminary Range Assessment (RIPRA) and their current status (e.g., active, in-active, or discontinued).

4. **Comment:** Firing Points not on active ranges should be within MRP Site boundaries. Please make appropriate changes to maps. (i.e., Firing Point C, D, F, and R for UXO 4, Firing Point T for UXO 5, etc.)

Response: The firing points not on active ranges have been included in both the SI and RI as range features that are subject to investigation. To clarify on the maps, the symbols denoting Firing Points C, D, E, F, R, and T have been revised on Figure INT-2 and other figures in Part 1 (MEC SAP) and Part 2 (MC SAP) to include a purple outline, and the purple outline entry in the corresponding legends has been revised to specify “Uprange Firing Fan **and Firing Point** Boundaries.”

5. **Comment:** On maps of UXO 6 please label UXO 2 and 7.

Response: The figures have been revised as requested.

6. **Comment:** Please provide disposal manifests for IDW in the Report following the work discussed in the RI SAP.

Response: The Part 2 (MC SAP), Section 14.2, subsection on IDW Management has been revised to include the statement: ***“IDW disposal manifests and end-user certifications for Material Documented as Safe (MDAS) will be appended to the RI Report.”***

7. **Comment:** Response to French Comment #6 from August 3, 2011 - The subject of borrow material which may have been excavated from UXO 4 and moved to another location was not discussed in the October 2011 Partnering Team Meeting and should be added to a future team meeting agenda.

Response: This topic will be discussed at a future Partnering Team meeting.

8. **Comment:** Response to French Comment #7 from August 3, 2011 - The statement, “The comment has been noted, and if Site 13 and UXO 2 overlap, an attempt will be made to coordinate remedies for these two sites” was made. It appears that the two sites do overlap; however, it does not appear that the remedies for these two sites have been coordinated. Please discuss.

Response: Text has been added to the UXO 2 Problem Statement in Part 2 (MC SAP) Section 11.1 to state: ***“In addition, the physical overlap of UXO 2 with Site 13C should be considered, and any future remedies deemed necessary at either site should be coordinated with those planned for the other site.”***

9. **Comment:** The Department reiterates April 28, 2011 Amick Comment #11 - “In the RI phase some munitions specific full MC samples should be taken at each range. If no background data is used for these sites, exceedances of metals cannot be automatically related to background. If the munitions used at UXOs 4, 5, and 6 contained copper, copper will be of significant interest because of copper impaired streams in the area.”

Response: Part 2 (MC SAP) calls for munitions-specific target samples to be collected at sites UXO 3, 4, 5, 6, 7, and 8, and for reported concentrations of MC that are also present in background to be compared to the background concentrations established for MCAS Beaufort. However, based on the discussion of background data among the Partnering Team at the October 2011 meeting, Part 2 (MC SAP) Appendix A has been expanded to include a full report evaluating the statistical comparisons between the MCAS Beaufort background data and recent data collected for background soil and sediment samples at MCRD Parris Island. The report includes recommendations for the assignment of appropriate background values for use in future MCRD Parris Island environmental investigations, which have been added to the project screening criteria tables that are now presented in Part 2 (MC SAP) Appendix F.

10. **Comment:** Part 1 Worksheet 10 Section 10.5.2 Page 44 - This section reads, “In one area where a number of anomalies were detected, the field geophysicist noted that the surface appeared to be covered with some type of oyster shell material typically used as fill, which also contained non-munitions related metal (e.g., pieces of fencing) in some areas...It is significant to note that this material came from an unknown source that may contain constituents unrelated to the historical use of the site as an artillery range.” More information is needed to determine if additional investigation is necessary (include photo logs, etc.).

Response: Additional investigation will be conducted in this area. Part 1 (MEC SAP) Section 17.1.2.1 has been revised to include the statement: ***“One of the survey grids at UXO 4 will be placed in the area where oyster shell fill material was observed during the SI.”*** The additional data collected from this area will help facilitate decisions regarding the potential hazards posed by

this material and the likelihood of finding range-related MEC in areas where similar fill material is present.

11. **Comment:** Part 1 Worksheet 10 Section 10.5.3.1 Page 46 and Part 2 Page 50 - Please clarify if any munitions or munitions type items were found during the construction of a building at Firing Point F at UXO 4. Also please note that Firing Point F will require at a minimum the LUC of notification that the area was part of a former munitions site.

Response: The last sentence of the last paragraph of Part 1 (MEC SAP) Section 10.5.3.1 and the last sentence of the fifth paragraph of Part 2 (MC SAP) Section 10.6.3.1 have been revised to state: ***"MEC are not expected to be present in the vicinity of this firing point because no munitions-related discoveries were reported during the construction of Building 730."*** The comment regarding LUCs has been noted.

12. **Comment:** Part 1 Page 55 - This statement appears on page 55, "No debris from 2.25 inch SCAR or HE bombs were found at this location, although the PI air station used these items at other locations in the Port Royal sound area [i.e., Formerly Used Defense Sites (FUDS)]." Please clarify if the FUDs mentioned have been forwarded to the Army Corp and are listed on the FUDs MIS (Management Information System).

Response: The statement regarding the FUDS was carried over from the Archives Search Report (ASR), which was developed by the U.S. Army Corps of Engineers. It is assumed that the Corps has properly documented the FUDS to which they referred because the sites are identified in Plate 6 of the ASR. To avoid confusion, the statement in Part 1 (MEC SAP) Section 10.8.1 and Part 2 (MC SAP) Section 10.9.1 has been revised to state: ***"No debris derived from other munitions [including subcaliber aerial rockets (SCAR) or HE bombs] has been found at this location."***

13. **Comment:** Part 1 Section 17.14.1 Page 125 and 17.14.5 Page 127 - The MEC Management section seems to indicate handling of MEC differently than was discussed in previous Partnering Team meetings. In previous team meetings it was stated that MCAS EOD personnel would be notified and respond immediately and determine appropriate action. In order for us to concur with what is written more information is needed about the magazine and the procedure proposed for use.

Please note: If MEC requires removal from a UXO site to be detonated (for example moving MEC from UXO 3 to UXO 4) a determination as to whether a RCRA emergency permit should be obtained from SCDHEC. However, if the munition is blown on the UXO site on which it is found and/or is sent to MCAS to be detonated at the OB/OD unit an emergency permit is not needed. Please provide clarification and make changes to the affected worksheets in the SAP.

Response: Part 1 (MEC SAP) Sections 17.14 and 17.15 have been revised per further discussions with MARCORSYSCOM, MCAS Beaufort EOD, and MCRD Parris Island on the process to be followed if/when MEC and MPPEH are encountered. The revisions reflect that Tetra Tech will conduct blow-in-place (BIP) activities to address MEC, and that MPPEH items will be transported to a central collection point within the site boundaries where they will be treated by detonation.

14. **Comment:** Part 1 Figure 17-3 - Please explain why no investigation of underwater anomalies is occurring in the waterway at UXO 4 where the most anomalies were found (anomalies 24-46) during the SI.

Response: Field personnel involved with data collection activities during the SI indicated that this area contained visible evidence of construction debris, which could be responsible for many of the underwater anomalies recorded. The presence of such debris accumulations would interfere with the ability of the planned RI investigation techniques to provide conclusive results regarding the

presence of underwater MEC/MPPEH. The three aquatic areas selected for further study during the UXO 4 RI will allow for the investigation of distinct anomalies in areas suspected of containing MEC/MPPEH without being hindered by the electronic and physical “clutter” expected at the Anomaly 24-46 location.

15. **Comment:** Part 2 Worksheet 17 Section 17.2 Page 103 - In order to clarify the administrative record please provide rationale for why soil samples at UXO 4 Firing Points A, B, C, D, E, and R will not be sampled for explosives.

Response: The rationale for why soil samples at the firing points were not going to be sampled for explosives during the RI was two-fold: a) incremental sampling (IS) was conducted to evaluate explosives at the firing points during the SI, and no explosives were detected; and b) any discarded munitions that might be found at the firing points during the RI are expected to be intact and unfired; therefore, no explosive MC would be exposed to the environment. However, to verify this assumption, the Part 2 (MC SAP) Section 17.2 subsection regarding Firing Points A, B, C, D, E, and R has been revised to state: ***“A subsurface soil sample will be collected from the one-foot interval directly beneath each [MEC/MPPEH] item and analyzed for metals and explosives.”*** Similar changes have been made to Part 2 (MC SAP) Section 17.3 to document explosives analysis at locations of MEC/MPPEH finds at the UXO 5 Firing Point T location. The additional explosives analyses to be conducted at these discretionary locations will also be reflected on Part 2 (MC SAP) Worksheets #18 and 19.

16. **Comment:** Part 2 Appendix A - Per the October 2011 team meeting it was decided that the statistical comparison of background at MCAS to the background at MCRD would be presented in an appendix of the first document in which the usage of background was applicable. Please present this comparison as part of the rationale for usage of the MCAS background at MCRD Parris Island.

Response: See response to Amick Comment 9.

17. **Comment:** Based on the Attachment to Response to Comments to the SI Work Plan for UXO Sites explaining DL, LOD, and LOQ, the detection limit should be presented in the RI Report. Additionally the detection limit should be below PALs for all analytes in all media. If low enough detection limits cannot be achieved an explanation should be provided in the report.

Response: A discussion of analytical detection limits is presented in Part 2 (MC SAP), Section 11.2, Bullet 7, pg. 67-68 and in the Worksheet #15 footnotes. As described, conventional laboratory analytical methods are unable to provide sufficient sensitivity to meet the risk-based PALs for all contaminants, so the indicated reporting conventions will be used. To ensure that detection limit issues are captured in the RI Report, a sentence has been add to the end of the first paragraph of Part 2 (MC SAP) Section 11.5 to state: ***“The RI Report will document the detection limits achieved by the laboratory for all sample analyses, and any associated uncertainties will be discussed in the risk assessment section.”***

Annie Gerry, Hydrogeologist
Federal Facilities Groundwater Section
Division of Waste Management

COMMENTS

1. **Comment:** Part II, Page 65, Section 11.2-Information Inputs, #5 Dissolved metals data: This section describes a possible turbidity issue with collecting groundwater samples for metals analyses from temporary monitoring wells. Turbidity issues can be minimized by proper design, installation, and development of monitoring wells and proper sampling techniques.

In addition, even though dissolved metals and total metal concentrations will be measured for comparison, the Department will base its decisions on total metal concentrations.

Response: This comment has been noted. The dissolved metals samples are being collected to provide supplemental data for situations in which turbidity issues cannot be resolved within practical time and resource constraints.

2. **Comment:** Part II, Page 81, Section 14.2-Field Tasks, Temporary Well Installation and Development: Please explain why the proposed temporary monitoring wells will have a 5 foot screen while Standard Operating Procedure (SOP) 11 states that wells will have a 10 foot screen. In addition, the Department takes this opportunity to remind the Navy that a request for installation of the temporary monitoring wells must be submitted under a separate cover to the Department prior to installing the wells, per the S.C. Well Standards, R.61-71.

Response: Part 2 (MC SAP), Section 14.2, Subsection on Temporary Well Installation and Development has been revised to specify 10-foot screens rather than 5-foot screens. The comment regarding the well installation request has been noted, and the Navy will submit that request prior to installing the wells.

Kent Krieg, Risk Assessor
Corrective Action Engineering Section
Division of Waste Management

COMMENTS:

1. **Comment:** Part II: SAP Worksheet #15 – Reference Limits and Evaluation Tables, page 88/90; Appendix A-3 – Project Action Level Backup Tables – During the initial soil screening for potential chemicals of concern, the Department requests that the SSL value remain at the default DAF value of 1. After this initial screening, the site specific DAF value may be calculated for further analysis. Please readjust the RBSSL values back to DAF = 1.

Response: Part 2 (MC SAP) Worksheet #15 and Appendix A-3 have been revised to adjust the RBSSL values back to DAF=1.

RESPONSE TO U.S. EPA COMMENTS DATED DECEMBER 2, 2011

DRAFT SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM REMEDIAL INVESTIGATION AT UXO SITES 2 THROUGH 8

Lila Llamas, Senior RPM
Federal Facilities Branch
Superfund Division

COMMENTS

GENERAL COMMENTS:

I. GENERAL COMMENTS – INTRODUCTION MANUAL

The Draft Sampling and Analysis Plan, Munitions Response Program Introduction: Unexploded Ordnance Sites 2, 3, 4, 5, 6, 7, and 8 dated September 2011 (Draft SAP Introduction) was reviewed. The review generated the following comments pertaining to the RIWP:

1. **Comment:** RIWP: EPA understands these documents are intended to meet the requirements of the Remedial Investigation Work Plan (RIWP) as committed to in the Site Management Plan (SMP) for the Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina. Please title them as such so credit can be given and the Administrative Record for the Site is clean and clear. A “SAP” does not necessarily contain all the requirements of a remedial investigation work plan. EPA has reviewed these documents for compliance with EPA’s guidance pertaining to RIWPs as requested verbally by the Navy.

Response: The overall document title has been changed from “Sampling and Analysis Plan” to “Remedial Investigation Work Plan.”

2. **Comment:** UPDATES BASED ON COMMENTS: Please make sure any changes which are deemed necessary based on these comments are made to all applicable worksheets, but especially 10, 11, 17, and 18 of both Parts 1 and 2.

Response: Changes made in response to comments have been made throughout the document to ensure consistency.

3. **Comment:** MEC, ETC.: Please include a brief explanation of the munitions related terminology as used in the Part 1 document. Modify the RIWP to include this and/or reference it. Due to inconsistent use and reference to “MEC” .vs. “MEC/MPPEH” .vs. “MEC and/or MEC-related debris” .vs. “considered to be munitions related debris and not MEC” comments have been included herein which clarify that EPA expects investigation, delineation, and associated risk assessed pertaining to all range-related materials, whether they be nails, wire, targets, munitions, explosive, non-explosive, whole, debris, unsafe, safe, etc. The same applies to Parts 1 and 2.

Response: The RIWP Introduction has been revised to include a Glossary of MEC-related terms, as defined in Appendix A of NAVSEA OP-5, Volume 1, Seventh Revision, Change 10. The usage of these terms has been reviewed, and appropriate changes have been made to ensure consistency throughout the RIWP.

As stated in the Part 1 (MEC SAP) Worksheet #11 study goals (see Sections 11.1.1, 11.2.1, 11.3.1, 11.4.1, 11.5.1, 11.6.1), the primary goal of the MEC RI is to determine whether, and to what extent, MEC and MPPEH are present at each site. Other DQOs presented in Worksheet #11 (including the decision rules) have been revised, as necessary, to reflect this goal by adding MPPEH where

the previous text identified only MEC. (It is noted that, by definition, MPPEH includes munitions debris and other range-related debris. Therefore, these items will be investigated and considered in the delineation of munitions response sites and the associated hazard/risk assessments.)

4. **Comment:** MMRP: The first paragraph of the Munitions Response Program discussion on Page 1 of 7 of the Draft SAP Introduction, and various pages in the Part 1 and 2 volumes contain the acronym “MRP” as the Military Munitions Response Program acronym. This differs from the acronym of “MMRP” that is assigned to this term in the Acronyms section of the documents. In addition, “MMRP” is the official acronym assigned to the noted term by the Department of Defense (DoD) in DoDM 6055.09-M-V8 (DoD Ammunition and Explosives Safety Standards, Volume 8, Glossary). That acronym should be used throughout the RIWP. Review the entire work plan and make this correction as necessary.

Response: The RIWP Introduction has been revised to distinguish between the Department of Defense’s overall MMRP established under the Defense Environmental Restoration Program (DoD, 2001) and the Department of Navy’s MRP described in the Navy Environmental Restoration Program Manual (DoN, 2006). Because this work is being implemented under both the broad authority of the DoD MMRP and the more specific direction of the DoN MRP, the uses of “MMRP” and “MRP” throughout the RIWP have been reviewed and revised, as necessary, to ensure that the appropriate program is referenced.

5. **Comment:** DATA GAPS: The text indicates Table INT-2 identifies data gaps remaining after the SI. However, some data gaps have been omitted (see EPA specific comments pertaining to Table INT-2 below.) The RIWP only appears to address some of the identified data gaps. A table indicating the data gaps expected to remain at each UXO after the RI is complete (i.e. areas not accessible for investigation, vertical data gaps due to differences between projected penetration depth of projectiles and limitations of survey equipment, vertical data gaps due to depth of fill above original grade and limitations of survey equipment, etc.) would help to ensure EPA and the Navy have a common understanding and expectation for what the RI is intended to accomplish. From EPA’s perspective, the scope of the RI is to address nature and extent for the areas being investigated and only to the extent of the applied technology limitations and/or intrusive investigations.

It should also be noted that horizontal data gaps exists between survey transects which are spaced a distance greater than the effective distance of the survey equipment. While this spacing may be sufficient to delineate nature and extent on a grand scale, it may not necessarily be sufficient for clearing an area of all hazards and hazardous materials. The Navy should be prepared to discuss the transect spacing in the RI report and what may or may not be inferred by the survey transects set at wide distances based on what is found for areas proposed as Non MEC.

The RI data gathered may be sufficient in areas to select and design a remedial response which may be able to clear the area more completely; or additional data may be necessary as part of a remedial response. It is difficult to be confident up front as to what will be the outcome of the investigation and exactly what decisions can be made from the data. A final determination of the status of various site areas investigated will only be known after the entire remedial process is complete. Even then, data gaps may still remain. Therefore, when the Draft SAP indicates “...regions will be considered by the Partnering Team for exclusion from further consideration as a part of the MRA”, although they will be considered, the Navy should recognize it is likely at a minimum Land Use Controls (LUCs) will be required.

Response: Table INT-2 has been revised to incorporate the additional data gaps remaining after the SI, as identified by EPA in Comment 6. (See response to Comment 6 for details.)

It is difficult at this time to predict what data gaps will exist following completion of the RI because interactive measures such as step-out surveys and contingency sampling are built into the RIWP as a means of addressing preliminary data gaps identified during field implementation. In addition, the data collected during intrusive investigations could possibly be used to eliminate some perceived data gaps (e.g., differences between penetration depth and instrument detection capabilities, existence and depth of fill material in certain locations, etc.). The RI Report will include a table presenting the data gaps that remain following the RI once the planned field investigation is complete and the data have been thoroughly evaluated.

As stated in the RIWP Introduction, the RI data “will be used to establish the nature and extent of MEC and MC contamination associated with the historical use of munitions at each of the UXO sites. The investigative approaches are designed to provide for the collection of sufficient site-specific data to evaluate risk and, if necessary, develop remedial alternatives.” Thus, specific design elements, such as survey transect spacing, are selected to ensure that distinct regions of concentrated MEC/MPPEH presence can be defined, not so that all anomalies within the site boundaries can be identified. The latter activity will be performed during site remediation, if and where the Partnering Team determines to be necessary. The investigative approaches outlined in the RIWP are designed to gather information for delineation/characterization purposes and not to clear the sites of all hazards. A discussion regarding conclusions that can reasonably be drawn based on transect spacing, site coverage, and survey results will be included in the RI Report. As necessary, additional investigation may be conducted during the remedial process to refine site boundaries and ensure that remedies are implemented effectively.

The comment regarding LUCs has been noted.

6. **Comment: TABLE INT-2: Several data gaps have been omitted, as described below. Modify the Table to reflect these in addition to what is already in the table and modify the RIWP to address the data gaps if possible and if not already addressed.**

- a) **UXO 1 – Until acceptable responses have been provided to EPA and the State regarding the possible existence of UXO 1 slightly removed from the proposed location, UXO 1 is not considered complete, and therefore the SI investigation is a data gap in itself for this UXO.**

Response: See response to Comment #7 below. Also, the revised RIWP Table INT-2 SI Data Gaps and Recommendations columns for UXO 1 are presented below.

INT-2

SI Data Gaps	Recommendations
None. <i>No field data has been collected to confirm the assumption that no grenade range existed at this location.</i>	No Further Action. <i>Expand the SI to include detector-aided surveys to determine whether physical evidence of grenade use exists at this location. Include biased MC sampling if evidence of grenade use is discovered.</i>

- b) **UXO 2 – Analysis of MC other than lead and delineation.**

Response: The SI Data Gaps column and Recommendations column of RIWP Table INT-2 have been revised as shown below. MC sampling is planned for UXO 2 to include the collection of soil and sediment samples to assess MC metals (antimony, arsenic, copper, lead, and zinc) and to delineate the extent of potential contamination in the area of the concrete target foundations. At the firing lines, incremental sampling (IS) samples will be collected for nitroglycerin (NG) analysis. Details of the additional MC sampling at UXO 2 will be conducted as part of the extended SI for this site, as described in the Extended SI Work Plan. RIWP Table INT-1 has also been revised to show

the media sampled during the SI, the sample depths, and analyses conducted. The revised RIWP Table INT-1 MC Sampling columns for UXO 2 are presented below.

Additionally, due to uncertainties regarding whether caches of bullets have been discarded near the firing lines or in the wooded area between the firing line and concrete target foundations, the recommendations for UXO 2 have been revised to incorporate detector-aided surveys in the subject locations. The plan for these surveys is also included in the Extended SI Work Plan.

INT-1

MC Sampling	
Surface Soil	Sediment
✓ <i>Inside the treeline, just north of the concrete target foundations; grab samples 0 - 12 inches bgs for lead analysis</i>	✓ <i>Areas surrounding the concrete target foundations; grab samples 0 - 6 and 24 – 36 inches bgs for lead analysis</i>

INT-2

SI Data Gaps	Recommendations
It is uncertain whether lead concentrations in surface soil and sediment would cause an unacceptable ecological risk or whether additional MC constituents may be present at concentrations that may pose either a human health or ecological risk. <i>It is uncertain whether caches of bullets may exist near the firing line or in the wooded area between the firing line and concrete target foundations.</i>	No Further Investigation. Expand the SI to include collection of additional soil and sediment samples to assess potential impacts from MC metals and to delineate the extent of contamination near the concrete target foundations. Include soil sampling at the firing lines to determine whether nitroglycerin may be present. An Ecological Risk Assessment is recommended. As part of the Expanded SI, conduct detector-aided surface surveys at firing lines and in the wooded area between the firing line and concrete target foundations to determine whether caches of bullets are present.

- c) UXO 3 – Inaccessible areas (paved) have not been investigated. Vertical delineation data gaps may exist where surveys were conducted due to noise and interference from numerous anomalies.

Response: The SI Data Gaps column and Recommendations column of RIWP Table INT-2 have been revised as shown below. The revised entries reflect that dense distributions of anomalies may create electronic clutter that masks underlying MEC or MPPEH items and that there is uncertainty regarding whether MEC or MPPEH may exist in the inaccessible areas beneath the pavement.

INT-2

SI Data Gaps	Recommendations
Subsurface anomalies identified within the grassy area to the north of the target center cannot be resolved without intrusive investigation. In places where anomalies are densely distributed, the resulting electronic clutter may mask underlying MEC/MPPEH items. It is uncertain whether anomalies exist in the non-surveyed areas, including the	Proceed to RI and conduct additional geophysical subsurface surveys; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in soil and groundwater.

<i>inaccessible areas beneath the pavement.</i> The Partnering Team has requested MC sampling at this site to evaluate chemical contaminants (<i>metals and explosives</i>) in soil and groundwater.	
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- d) **UXO 4 – Vertical delineation data gaps exist in all areas surveyed, land and aquatic; horizontal and vertical delineation in all inaccessible areas; data gaps for MC other than lead, including propellants, at firing point C and propellants at all other firing points (see MC comments).**

Response: It is agreed that vertical delineation data gaps may exist in surveyed areas due to the difference between instrument detection sensitivities and the theoretical penetration depths of munitions used at this site. It is also agreed that horizontal and vertical data gaps exist in the inaccessible areas. However, as discussed with EPA on 12/20/11, the Navy notes that explosives sampling was conducted at numerous locations during the SI, including the firing points, impact area, and waterways. Soil and sediment samples were collected for lead and explosives analysis within the impact area, and soil samples were collected for lead and explosives analysis at all firing points not located on active ranges. The explosives analyses included propellants that were possible constituents of the munitions used at UXO 4.

RIWP Table INT-1 has been revised to show the media sampled during the SI, the sample depths, and analyses conducted. The revised RIWP Table INT-1 MC Sampling columns for UXO 4 are presented below. Additional sampling for metals and explosives analysis is planned during the RI for the impact area and for the firing points and waterways if MEC or MPPEH are identified during the intrusive or aquatic investigations of anomalies. RIWP Table INT-2 has also been revised to add information that clarifies the data gaps and recommendations for UXO 4, as shown below.

INT-1

MC Sampling	
Surface Soil	Sediment
✓ <i>Firing Points: To Grab samples 0 - 12 inches bgs for lead analysis, incremental samples 0 – 6 inches bgs for explosives⁽²⁾ analysis. Select Portions of the Impact Area: XRF screening 0 – 12 inches bgs, grab samples 0 – 12 inches bgs for lead analysis, incremental samples, 0 – 6 inches bgs for explosives⁽²⁾ analysis at firing points and select portions of impact area</i>	✓ <i>Select Portions of Impact Area: XRF screening 0 – 6 inches bgs, grab samples 0 – 6 inches bgs for lead analysis</i> <i>Waterways: to 6 inches bgs; and Grab samples top 6 inches of submerged sediment for lead and explosives⁽²⁾ analysis</i>

2 Explosive analysis included: 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; 2-amino-4,6-dinitrotoluene; 2-nitrotoluene; 3-nitrotoluene; 4-amino-2,6-dinitrotoluene; 4-nitrotoluene; HMX; nitrobenzene; RDX; and tetryl. Propellants that may have been constituents of munitions used at UXOs 4, 5, and 6 are included in this list.

INT-2

SI Data Gaps	Recommendations
Not all accessible areas within <i>the</i> firing fan and impact area boundaries were investigated during <i>the</i> SI, <i>nor were inaccessible areas investigated. Detection depths achieved during surveying were not to the theoretical</i>	Proceed to RI <i>and conduct additional detector-aided surface and subsurface geophysical surveys within the impact area and at the firing points, as appropriate; intrusive investigation of select SI and RI anomalies; underwater imaging of aquatic anomalies;</i>

SI Data Gaps	Recommendations
<p>maximum penetration depth for munitions used at this site (land and aquatic). Lead contamination at Firing Point C was not spatially bounded. Additional data is needed to quantify MC concentrations (including metals and explosives) in soil, sediment, and groundwater due to MEC presence. Subsurface anomalies cannot be resolved without intrusive investigation. Aquatic anomalies require further investigation. The Partnering Team has requested geophysical surveys and intrusive investigations at all firing point locations.</p>	<p>and MC sampling for metals and explosives in soil, sediment, and groundwater.</p>

- e) UXO 5 – Data gaps exist for MC other than lead, including propellants, at firing point; inaccessible areas of range fan have not been investigated.

Response: It is agreed that inaccessible areas of UXO 5 have not been investigated. However, as discussed with EPA on 12/20/11, the Navy notes that explosives sampling was conducted at the UXO 5 firing point during the SI. An IS for explosives analysis was collected at the presumed location of the firing point, although that location may not have been correctly interpreted from historical documents. Thus, an area adjacent to the SI study area will be investigated through detector-aided surveys and IS sampling for explosives during the RI. RIWP Table INT-1 has been revised to show the media sampled during the SI, the sample depths, and analyses conducted. The revised RIWP Table INT-1 MC Sampling columns for UXO 5 are presented below. RIWP Table INT-2 has also been revised to add information that clarifies the data gaps and recommendations for UXO 5, as shown below.

INT-1

MC Sampling	
Surface Soil	Sediment
<p>✓</p> <p>Grab samples 0 - 12 inches bgs for lead analysis, incremental sample 0 – 6 inches bgs for explosives⁽²⁾ analysis To 12 inches bgs at firing point</p>	<p>--</p>

2 Explosive analysis included: 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; 2-amino-4,6-dinitrotoluene; 2-nitrotoluene; 3-nitrotoluene; 4-amino-2,6-dinitrotoluene; 4-nitrotoluene; HMX; nitrobenzene; RDX; and tetryl. Propellants that may have been constituents of munitions used at UXOs 4, 5, and 6 are included in this list.

INT-2

SI Data Gaps	Recommendations
<p>Due to lack of historical documentation regarding the precise location of Firing Point T and lack of physical evidence recovered during the SI, it is uncertain whether the presumed firing point location is correct. Not all accessible and inaccessible areas within range fan were investigated during SI, including the</p>	<p>Proceed to RI and conduct detector-aided surface and subsurface geophysical surveys at the revised firing point location; intrusive investigation of select anomalies (if identified); and MC sampling for metals and explosives in soil.</p>

<i>waterway that traverses the site.</i> Partnering Team has requested geophysical surveys <i>and intrusive investigation</i> at the firing point location.	
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- f) **UXO 6 – Vertical data gaps exist for small land areas surveyed on western edge and all aquatic areas surveyed; data gap for MC other than lead for sediment samples.**

Response: It is agreed that vertical delineation data gaps may exist in surveyed areas due to the difference between instrument detection sensitivities and the theoretical penetration depths of munitions used at this site. However, as discussed with EPA on 12/20/11, the Navy notes that explosives sampling was conducted at numerous locations within the UXO 6 impact area. Sediment samples were collected for lead and explosives analysis within the impact area waterways and at several locations on the land-based portions that were accessible by foot. The explosives analyses included propellants that were possible constituents of the munitions used at UXO 6.

Table INT-1 has been revised to show the media sampled during the SI, the sample depths, and analyses conducted. The revised Table INT-1 MC Sampling columns for UXO 6 are presented below. Additional soil and sediment sampling for metals and explosives is planned during the RI for the land and waterways if MEC or MPPEH are identified during the intrusive or aquatic investigations of anomalies. Table INT-2 has also been revised to add information that clarifies the data gaps and recommendations for UXO 6, as shown below.

INT-1

MC Sampling	
Surface Soil	Sediment
--	<p style="text-align: center;">✓</p> <p><i>Small area along the western boundary of impact area: grab samples 0 - 6 and 24 – 36 inches bgs for lead and explosives⁽²⁾ analysis</i> <i>Waterways: Grab samples top 6 inches of submerged sediment for lead and explosives⁽²⁾ analysis</i> Top 6 inches of submerged sediment</p>

2 Explosive analysis included: 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; 2,4,6-trinitrotoluene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; 2-amino-4,6-dinitrotoluene; 2-nitrotoluene; 3-nitrotoluene; 4-amino-2,6-dinitrotoluene; 4-nitrotoluene; HMX; nitrobenzene; RDX; and tetryl. Propellants that may have been in munitions used at UXOs 4, 5, and 6 are included in this list.

INT-2

SI Data Gaps	Recommendations
Most areas within the firing fan and impact area consist of marshland that is not accessible for investigation <i>and was not investigated during the SI.</i> Small land masses on western perimeter could be <i>were</i> investigated to confirm clean boundaries of contamination. Aquatic anomalies require investigation. <i>Detection depths achieved during surveying were not to the theoretical maximum penetration depth for munitions used at this site (land and aquatic). Additional data is needed to quantify MC</i>	Proceed to RI <i>and conduct additional detector-aided surface and subsurface geophysical surveys within the impact area; intrusive investigation of select SI and RI anomalies; underwater imaging of aquatic anomalies; and MC sampling for metals and explosives in soil and sediment.</i>

concentrations (including metals and explosives) in soil and sediment due to potential MEC presence.	
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- g) UXO 7 – Vertical data gaps exist in areas surveyed; vertical and horizontal data gaps exist in areas not surveyed – data gap to the north and south of the target area.

Response: It is agreed that vertical data gaps may exist in surveyed areas due to the difference between instrument detection sensitivities and the potential depths of munitions used at this site that may be buried beneath fill material. Table INT-2 has been revised to add information that clarifies the data gaps and recommendations for UXO 7, as shown below.

INT-2

SI Data Gaps	Recommendations
Subsurface anomalies cannot be resolved without intrusive investigation. <i>Detection depths achieved during surveying may not have been sufficient to detect buried MEC/MPPEH items in places where fill material is present. It is uncertain whether anomalies exist in areas outside of the SI survey areas.</i> Partnering Team has requested MC sampling to evaluate chemical contaminants (<i>metals and explosives</i>) in soil and groundwater, and investigation below the native soil/fill horizon.	Proceed to RI <i>and conduct additional detector-aided surface and subsurface geophysical surveys in areas north and south of the original target area; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in soil and groundwater.</i>

- h) UXO 8 – Vertical data gaps exist in all areas surveyed.

Response: It is agreed that vertical data gaps may exist in surveyed areas due to the difference between instrument detection sensitivities and the theoretical penetration depths of munitions used at this site, as well as due to the dense distributions of anomalies caused by surface debris that may have masked the presence of underlying MEC or MPPEH items. Table INT-2 has been revised to add information that clarifies the data gaps and recommendations for UXO 8, as shown below.

INT-2

SI Data Gaps	Recommendations
Additional areas require survey where practice bomb fragments are present. Surface debris must be removed prior to survey to reduce electronic clutter. Subsurface anomalies cannot be resolved without intrusive investigation. <i>Detection depths achieved during surveying were not to the theoretical maximum penetration depth for munitions used at this site.</i> Partnering Team has requested MC sampling (<i>metals and explosives</i>) to evaluate chemical contaminants in sediment.	Proceed to RI <i>and conduct additional detector-aided surface and subsurface geophysical surveys after removing surface debris in previously surveyed areas and adjacent, expanded areas; intrusive investigation of select SI and RI anomalies; and MC sampling for metals and explosives in sediment.</i>

7. **Comment:** UXO 1: The information requested in the Site Investigation (SI) Report Conditional Approval letter from EPA has not yet been provided. EPA cannot approve a No Further Action (NFA) recommendation in the SI report until EPA's concerns have been addressed. Unless the conditions for approval are met, EPA expects UXO 1 to be further

investigated. EPA would not be able to approve a Remedial Investigation Work Plan (RIWP) which indicates the investigation of UXO 1 has been completed. The Navy should either provide the necessary documentation to address EPA's concerns and obtain final approval of an NFA recommendation in the SI Report or indicate in the RIWP that the UXO 1 investigation is not yet complete and will be addressed separately. Modify text as necessary throughout the RIWP (text, tables, figures, etc.). The information EPA requested regarding the SI Report recommendation was as follows:

“RTC #2, #9, and #17: Additional information is needed in support of the text which was added to ES-1, page 1-1, and the response to #17, before a proposal of No Further Action (NFA) can be approved by EPA. Please provide a map showing the boundaries of the active “Weapons and Field Training Battalion Area”, Range A, Range B, Range C, and Range D as addressed in the ASR and/or PA. Also provide the text for each describing the historical activities within these areas. If the maps indicate all of the noted grenade areas are overlapped by active range boundaries, and the text for these active ranges includes a historical record of these grenade range activities being conducted within (especially helpful would be if they specifically reference Figures G-13 and G-19), then it may be assumed that these areas of concern would be tracked within these operational ranges and addressed when the ranges are closed, and UXO 1 can be approved for NFA. Otherwise, EPA suspects the telephone interview reference to “well behind” was most likely misinterpreted either directionally and/or proportionally, and Figures G-13 and G-19 actually capture the mentioned activity. If the ASR/PA boundaries and discussions do not overlap or include these historical activities as part of the aforementioned ranges, then either UXO 1 will need to be carried forward into the RI or a new UXO number should be assigned to the recorded activity on the figures and a determination made as to whether to address it now or later with other UXO sites to come.”

Response: The SI Report change pages containing additional information regarding UXO 1 were inadvertently omitted from RIWP Introduction Appendix A. The pages that should have been included in the 9/30/11 transmittal were emailed from P. Churchill to the Team on 12/6/11. Further edits have been made based on this comment and subsequent discussions with the Partnering Team. The revised SI Report change pages will be transmitted with the Expanded SI Work Plan in February 2012.

The revised SI Report change pages reflect the possibility that the location of UXO 1 was misinterpreted due to the limited information provided in the Swearngen interview, and that the UXO 1 grenade range may actually coincide with one of the other grenade ranges documented in the ASR. Figures have been added to illustrate the other possible locations of this grenade range, including Figure 4-2 (Archives Search Report [ASR] Appendix Figure G-13) and Figure 4-3 (ASR Appendix Figure G-19). The locations of these historical grenade ranges, as identified in the ASR, are within the present-day Weapons and Field Training Battalion Area (WFTBn) and are, therefore, overlapped by active range boundaries. Text from the ASR (Sections 7.2.1 through 7.2.6) presented below has been added to the SI Report (Section 4) to provide information on the active ranges presently located with the WFTBn Area. Grenade practice is described in Sections 7.2.1 and 7.2.5 of the ASR, and the figures referred to in these sections are included in Appendix L of the SI Report. Historical grenade use within the WFTBn Area will be addressed at a later date as part of investigation and remediation activities associated with closure of the active ranges.

Below is the text regarding active ranges that has been added to SI Report Section 4.

7.2.1 Khe Sanh/Range A

This is an active, multipurpose infantry weapon, live fire range in the Weapons and Field Training Battalion area. The range began in 1918 as the 1,000 Yard Range of the “New Rifle Range,” which replaced the earlier range at Ballast Creek. During World War II, additional uses included hand grenade courts and rifle grenade circles. Primarily used as a machine gun field firing range in 1999, it is also used for familiarizing troops with light anti-tank/anti-armor (subcaliber) weapons

with the AT-4 9mm training device, an M16 rifle field firing range and an M203 range for 40mm practice grenades. In addition to these ranges, a day movement course was incorporated into the southern area in the 1990s. The location of this range is shown on historical maps in ASR Appendix G-4, 6, 13, 17, 19, 23-28, 30, and 32 and on ASR Plates 3 and 7.

7.2.2 Hue City/Range B

This is an active, 600-yard known distance rifle range in the Weapons and Field Training Battalion area. It is the western most of the four parallel known distance ranges at Parris Island. The range began in 1918 as the 600-Yard Range of the "New Rifle Range." In 1930, the range was reconstructed at approximately the same location to allow for the longer-ranging caliber of the .30 M1 ammunition adopted by the Marine Corps. This required reorienting the range in a more northwesterly direction. Improvements and modifications have been made over the years since then. The location of this range is shown on historical maps in ASR Appendix G-6, 13, 17, 19, 23-28, 30 and 32 and on ASR Plates 3 and 7.

7.2.3 Chosin/Range C

This is an active, 500-yard known distance rifle range in the Weapons and Field Training Battalion area. It is the western, middle range of the four parallel known distance ranges at Parris Island. The Marine Corps built the range in 1942, during the World War II era facility expansion. The range appears to originally have had 600-yard firing lines. The location of this range is shown on historical maps in ASR Appendix G-17, 19, 23-28, 30 and 32 and on ASR Plates 3 and 7.

7.2.4 Starlight/Range D

This is an active, 500-yard known distance rifle range in the Weapons and Field Training Battalion area. It is the eastern, middle range of the four parallel known distance ranges at Parris Island. The Marine Corps built the range in 1942, during the World War II era facility expansion. The range appears to originally have had 600-yard firing lines. Aerial photo analysis of 1945 imagery indicates that a range with a westerly direction of fire existed across Ranges D and E, possibly in the 1930s. No other documentation was found to confirm this use. The location of this range is shown on historical maps in ASR Appendix G-17, 19, 23-28, 30 and 32 and on ASR Plates 3 and 7.

7.2.5 Inchon/Range E

This is an active, 500-yard known distance rifle range in the Weapons and Field Training Battalion area. It is the eastern most of the four parallel known distance ranges at Parris Island. Construction on the known distance range was completed by 1970 but the location had several earlier ranges present. Site plans show a hand grenade practice area at this location from approximately 1944 to 1968 and a grenade pit from 1953 to 1970. Aerial photo analysis from 1945 to the 1960s, show a less developed range paralleling Ranges B, C and D with firing lines at about 100, 200 and 300 yards. Another less distinct range is visible in 1945, with a westerly direction of fire across Ranges D and E. Two circular Snap-In or Dry Fire ranges also are discernable in the 1945 imagery. The 1937 Artillery Firing Concrete Firing Position H also appears to have been located on this range. The location of this range is shown on historical maps in ASR Appendix G-9, 10, 17, 19, 23-28, 30 and 32 and on ASR Plate 3 and 7.

7.2.6 Pusan Range, Nak Tong Range and Recreational Firing Range (Broad River Small Arms Ranges)

These three pistol ranges are part of a complex of active and historical small arms ranges with target butts arrayed along the Broad River shoreline, west of Range A in the Weapons and Field Training Battalion area. The ranges have been modified and reconfigured a number of times, since a Pistol Range was completed here in 1918, as one of the three ranges associated with the "New Rifle Range." By 1941, a .22 caliber Range was added but the World War II expansion saw the development of the site for Small Bore Ranges Nos. 1 through 8. Some of these ranges were later reconfigured into other ranges [i.e. Nos. 7 and 8 became the Skeet Range (1946-1953) and later a 900-inch Range (1973)] or abandoned. By 1952, Building 788 has been constructed as an

Electric Pistol Range. As of 1999, most of the ranges have been abandoned, dismantled, or reconstructed and only three remain. The Marine Corps uses **Pusan Range** for service pistol practice and qualification. The **Nak Tong Range** is a close combat pistol range that is also used for shotgun and handgun qualification. The **Recreational Firing Range** dates back to at least 1989 and is used solely for recreational firing of privately owned handguns, no magnum calibers being permitted. The location of this range is shown on historical maps in ASR Appendix G-6, 13, 17, 19, 23-28, 30, 32 and on ASR Plate 3 and 7.

In addition to the SI Report edits, a new figure has been added to the RIWP Introduction (Figure INT-3), which shows the locations of all active training areas (including the WFTBn Area), as well as the approximate boundaries of all ranges identified in the Range Identification and Preliminary Range Assessment (RIPRA), if known. To supplement this figure, a table has been added to the RIWP Introduction indicating the status of each range (e.g., Active, Inactive, or Discontinued) and the source of information used to identify the range location on the figure. Due to the lack of historical documentation and uncertainty that exists regarding the actual location of UXO 1, further investigation is planned at the presumed location identified in the ASR. The work will be conducted as an Expanded SI and will include detector-aided surface surveys, intrusive investigation of detected anomalies, and sampling for munitions constituents (MC). The Expanded SI Work Plan will be submitted to the Partnering Team in February 2012.

8. **Comment: NATURAL RESOURCE TRUSTEES (NRTs):** Ensure review and comment is obtained from the Natural Resource Trustees if they desire to comment. EPA has briefly discussed the RIWP with SCDNR and a few issues and questions raised in those discussions are reflected in these comments. However, this in no way is intended to reflect a complete review on behalf of NRTs. NRTs should indicate to the Navy whether or not they wish to comment further.

Response: The SCDNR trustee has indicated (by phone and email) that her comments were already incorporated in the version of EPA's comment letter that she received/reviewed in November. The NOAA trustee has indicated (by email) that she will not be submitting comments at this time.

9. **Comment: SEDIMENT CHARACTERIZATION:** EPA is not aware of receiving the CH2MHill 2009 Sediment Characterization Report on CD yet as requested as part of the conditional approval of the MMRP SI Report. Either it has not been submitted or it was misplaced. EPA will not be able to review a revision of the RIWP prior to submittal and review of the Sediment Characterization Report.

Response: CDs containing the 2009 Sediment Characterization Report were shipped to EPA and SCDHEC on 12/16/11.

10. **Comment: WATERSHED CONTAMINANT SOURCE DOCUMENT:** This document has been identified as a data input in the RIWP. Please provide whatever is available at this point in time (e.g. preliminary data/findings/conclusions, draft document, etc.)

Response: A draft version of the Watershed Contaminated Source Document will be transmitted to the Team along with the Expand SI Work Plan in February 2012. Information to be presented in this document indicates that there are no upstream sources of contamination that significantly impact sediment conditions in the UXO 4 and UXO 6 waterways planned for sampling under the Parris Island MRP RIWP.

11. **Comment: UXO 2:** No additional investigation or samples have been recommended for UXO 2. While it appears the number of samples may be sufficient, questions remain as to the analysis performed, eco risk assessment methodology, etc.

Response: The RIWP Introduction and Part 2 (MC SAP) Section 10.4.2 have been revised to indicate that additional MC sampling will be conducted at UXO 2 under the Expanded SI for the purpose of bounding the lead contamination in sediment near the targets, evaluating metals other than lead associated with small arms ammunition, and evaluating the potential presence of nitroglycerin in surface soil at the firing lines. The plan for this work is described in the Expanded SI Work Plan. Results will be discussed in the RI Report.

Please answer the following and provide clarifying language in the RIWP as necessary:

- a) **Reportedly studies have been conducted in and around Parris Island, some of which pertain directly to ranges, which revealed elevated levels of copper, etc. in the marsh and intertidal waterways. Please briefly describe the nature of the elevated metals levels in and around Parris Island. Identify which areas are elevated, which are of concern, what is believed to be the source of the copper, etc. Identify the areas on a map. Identify the source of the information.**

Response: Part 2 (MC SAP) Worksheet #10 has been revised to include a summary of findings from the Sediment Characterization Report (CH2MHill, 2009), which evaluated the impacts of small arms firing range activities in the Weapons and Field Training Battalion (WFTBn) Area on the surrounding sediments of the Broad River, tidal creeks, and intertidal marshland. This report documents elevated levels of copper in the sediments in the WFTBn Area due to the weatherization and degradation of copper-jacketed bullets fired from the active small arms ranges.

- b) **Please explain why, even though lead exceeded screening values and generated NOAELs greater than 1, no additional samples are necessary in order to analyze for a more complete analyte list, rather than just lead, for use in a risk assessment. The argument made in the text indicates a relationship between lead and other metals which may be true in a controlled environment but is not necessarily true at the site. Copper jackets may be exposed even though lead internal to the jacket is not. The fate and transport of lead at the site may not be the same as fate and transport of the other metals. It has been reported to EPA that levels of Copper are elevated in some intertidal creeks and marsh areas of Parris Island. It is also noted in the SI that lead exceeded ESLs. Given the potential for copper and other contaminants from the bullets, and given these factors mentioned here, it would seem appropriate to sample again and analyze for the appropriate UXO 2 MC analytes of concern. Unless EPA can be convinced otherwise by the Navy's response to this comment, EPA's position is that additional samples and analysis should be added for MC at UXO 2 in soil and sediment. Modify the RIWP to address this (Intro and Part 2.)**

Response: The Expanded SI Work Plan discusses the collection of additional soil/sediment samples from the target area at UXO 2 for analysis of lead and other metals associated with small arms ammunition (antimony, arsenic, copper, and zinc).

- c) **Since MC sediment samples are to be taken, they should be distributed from the targets and around toward the direction of the elevated levels in the SI Figure 5-3 (S, SE, and E of the target concrete foundations) to provide analysis of MC other than lead in the area of lead exceedances. Modify the RIWP as necessary (Intro and Part 2).**

Response: The additional samples to be collected as part of the Expanded SI are placed at locations selected to delineate the extent of screening level exceedances observed during the SI, especially downrange of the targets.

- d) **Reflecting on the study conducted at the Weapons Field Training Battalion (WFTB) explain where the bullets/bullet fragments were eventually located relative to the projected trajectory and expected point of impact for the weapons fired on the WFTB. Apply lessons learned from the WFTB study to UXO 2 and explain how far past the**

target bullets may have been expected to land and how deep they would be expected to have sunk, and where they would have been expected to have migrated to today. If point of impact and the anticipated location today would be further removed from the UXO 2 shore than the samples which were taken, explain why no samples are necessary in the area where bullets would be anticipated to be today. Otherwise, if the anticipated location is different, provide for sampling the anticipated location. Design the approach based on the WFTB study and lessons learned (e.g. if samples are to be taken in an area more removed from the shoreline, distribute additional sediment sample locations between the projected point of impact and the location the bullets are expected to be today. Examine the cores for presence of bullets and bullet fragments and report (MEC investigation), in addition to collecting samples for UXO 2 MC analysis. Modify the RIWP to address this (Intro, Part 1 & 2.)

Response: See RTC 11a. The discussion added to Part 2 (MC SAP) Worksheet #10 regarding the Sediment Characterization Report addresses the similarities and differences between the historical Rifle Range at Ballast Creek (UXO 2) and the active Small Arms Ranges at the WFTB Area. The discussion notes that bullets are expected to be dispersed over greater distances at the active ranges than at UXO 2 due to the more powerful propellants in use today compared to the early 1900s, and that MC concentrations are expected to be higher at the active ranges than at UXO 2 because the active ranges have been in continuous use for more than 60 years, some since 1918, whereas UXO 2 was used as a rifle range for only three years, from 1916 to 1918. Thus, the overall contaminant loading associated with this range is expected to be very low compared to that of the active WFTB ranges.

- e) Please explain if there are records of whether the area of concern has been dredged or not. If so, describe the dredging efforts. Also, please explain where the dredged materials were disposed. Relate this information to the projected location requested in the bullet above. Modify the RIWP as necessary (Intro, Part 1 & 2.)

Response: Part 2 (MC SAP) Section 10.4.1 has been revised to incorporate additional information presented in the ASR, which states that the "...Rifle Range at Ballast Creek ... has been heavily regraded and reportedly received dredge spoil in the past," and also that "Most of the land for this range has since been covered by dredge fill..." It is assumed that the area that received dredge spoils after the range closed is the area currently being investigated as IR Site 13c.

- f) Please explain why it can be said that there is no reasonable expectation of future residential development use at UXO 2. Also, since additional samples are to be taken, results should be screened against both HH and Eco screening levels. If contaminants exceed HH screening levels and if residential use and/or other human health exposure scenarios are not assessed, Land Use Controls restricting potential uses will be required. (Intro and Part 2)

Response: The last sentence of Part 2 (MC SAP) Section 10.4.3.3, first paragraph has been revised to state: ***"Future land use is assumed to be the same as current land use, with no reasonable expectation of future residential development in the marshy areas where lead-contaminated sediment is present."*** Part 2 (MC SAP) Worksheet #11 has been revised to state that the RI risk assessment for UXO 2 will include screening the analytical data against the PALs specified in Worksheet #15, which include both HHRA and ERA screening levels.

- g) Regarding the ERA, please explain what concentration of lead was used in the conservative scenario and what concentration was used in the average scenario, and how these concentrations were selected/derived (i.e. was the maximum concentration used in both scenarios? Was the maximum used in the conservative scenario? If an average concentration was calculated for the average scenario, which sample results were averaged together and why?) Modify the RIWP to explain this. (INT Appendix)

Response: The Ecological Risk Screening presented in RIWP Appendix A has been revised to state: ***“For the conservative scenario, the maximum concentration of lead was used. The value used for soil was 15.5 mg/kg, and the value used for sediment was 142 mg/kg. For the average scenario, the average lead concentration for all samples was used to provide a more realistic exposure scenario as is typical in ecological risk assessments. The value used for soil was 12.2 mg/kg, and the value used for sediment was 74.1 mg/kg.”***

- h) **Correct the apparent error in the INT Appendix - RTC regarding UXO 2 – ERA page 4, last paragraph, where the second appearance of “112” should be “142” mg/kg. (INT Appendix)**

Response: The error has been corrected.

- i) **Reconcile the inconsistencies between text language and table language for the maximum concentration sediment sample number (INT Appendix RTC regarding UXO ERA Page 4 and Table 1-5). Modify the RIWP. (Intro and INT Appendix)**

Response: The inconsistencies have been corrected by changing the sample designations.

- j) **The Navy should consider coordinating the investigation of UXO 2 with that of Site 13c and Site 4, since they are apparently co-located. EPA has provided the Navy with path-forward instructions as part of the SI/CS for these other sites. Modify the RIWP as appropriate.**

Response: The Navy acknowledges that there is site overlap among UXO 2 and IR Sites 13c and 4, and is considering this in the design of the Expanded SI activities at UXO 2. However, it is noted that the CSM for UXO 2 (MC in soil/sediment due to firing line activities and the physical presence of bullets in the target area) is different than the CSM for the IR sites. Therefore, a site-specific risk assessment is warranted for UXO 2. (See also response to Amick Comment 8.)

- 12. **Comment: SITEWIDE ECO RISK ASSESSMENT: The RIWP indicates large carnivorous birds were not selected as assessment endpoints at UXO 2 because their home range (hundreds of acres) is much larger than the site (17 acres). They also were not identified in the list of potential ecological receptors for UXOs 4, 5, and 6, although these sites are over a thousand acres each. It is recommended to include an eagle in these ERA's as a representative of the large carnivorous bird group, as one has been known to live in the area. In addition to inclusion in the larger UXO sites individually (4, 5/6) it is recommended an exposure scenario be included which uses data from all UXO sites within a possible range area (e.g. 2, 5, 6, 7, 8, and 4). Use the maximum concentration from all sites, but then also average across sites and take into consideration what portion of the range area the UXO sites would account for (i.e. allow for non-site areas within the range area if appropriate). Modify the RIWP to address this issue. (Part 2)**

Response: The Navy does not agree that this approach is a valid means for evaluating ecological risk at UXO 2 because the sample data sets for the other UXO sites is not representative of the entire home range of large carnivorous birds or mammals. Sample data collected during the SI was biased toward locations known or suspected to be impacted due to historical munitions activities (e.g., firing points, target locations, impact areas). Samples were not collected throughout the entire firing fan or at non-impacted locations within the site boundaries. The extrapolation of data only from impaired areas to an entire UXO site or the entire MCRD installation would not provide a realistic exposure scenario for large carnivorous birds and mammals since only a small portion of their home range would be impacted. It is important to note that insectivorous species are at greater risk from exposure to metals such as lead, as evidenced by the USEPA ecological soil screening levels (Eco SSLs) for lead for various insectivorous versus carnivorous avian and mammalian species. For example, the Eco SSL for insectivorous birds is 11 mg/kg, whereas the Eco SSL for carnivorous birds is 510 mg/kg. Also, the Eco SSL for insectivorous mammals is 56

mg/kg, whereas the Eco SSL for carnivorous mammals is 460 mg/kg. None of the detected concentrations in UXO 2 soil or sediment exceed the Eco SSLs for carnivorous species.

13. **Comment: ENDANGERED, THREATENED, OR POTENTIALLY PROPOSED SPECIES:** Please clarify if any of the UXO Sites contain habitat which would be used by any of the species listed in the SI Report, especially those known to inhabit Beaufort County, including migratory species. If so, modify the RIWP to consider these as potential receptors.

Response: During the ERA process, representative receptors will be selected to represent likely species that could be impacted by site-related activities. This will include a consideration of threatened and endangered species based on receptor class. A full description of potential threatened and endangered species will be included in the ecological risk assessments when they are presented in the RI Report. In addition, both Part 1 (MEC SAP) and Part 2 (MC SAP) have been revised to include additional summary information in Section 10.2.8, Threatened or Endangered Species, and to add Section 10.2.9, Natural Resources, which states: ***“To ensure that the MRP investigation does not create any adverse impacts on natural resources, fieldwork will be conducted in coordination with the MCRD Parris Island Natural Resources Department, and ecologically sensitive habitats will be avoided.”***

14. **Comment: DECISIONS:** While the approach presented appears to be sound, the complexity of site issues and the many combinations of possible scenarios which could play out make it difficult to be confident there will not be any need for additional data. Therefore, EPA retains the right to determine if delineation is sufficient or not once results have been presented. Additional sampling may be necessary in order to fill data gaps if identified.

Response: Comment noted. This is consistent with the Performance/Acceptance Criteria presented in Worksheet #11 of both Part 1 (MEC SAP) and Part 2 (MC SAP).

II. GENERAL COMMENTS – PART 1 MEC

The Draft Sampling and Analysis Plan, Munitions Response Program Part 1: Munitions and Explosives of Concern Remedial Investigation at Unexploded Ordnance Sites 3, 4, 5, 6, 7, and 8 dated September 2011 (Draft SAP Part 1) was reviewed and generated the following comments pertaining to the RIWP:

15. **Comment: GLOBAL CHANGES:** See comments on Introduction and/or Part 2 which may require changes to Part 1 as well.

Response: Changes made in response to comments have been made throughout the entire document to ensure consistency.

16. **Comment: UXO 2:** See General Comments for Introduction Manual regarding bullets in sediment. Modify the RIWP.

Response: UXO 2 is not addressed in Part 1 (MEC SAP) because there is no expectation of encountering MEC at this site. Ammunition fired at this range consisted of .30-caliber bullets, which do not constitute MEC. Potential impacts due to accumulations of bullets and the plan for additional MC sampling are discussed in Part 2 (MC SAP) and addressed in the Expanded SI Work Plan. (See also Responses to Comments 6 and 11.)

17. **Comment: MEC, ETC.:** Please include a brief explanation of the munitions related terminology as used in the Part 1 document. Modify the RIWP to include this and/or reference it.

Response: The RIWP Introduction has been revised to include a glossary of MEC-related terms, as defined in NAVSEA OP-5, Volume 1, Seventh Revision, Change 10. In addition, the second paragraph of the Part 1 (MEC SAP) Executive Summary has been revised to refer the reader to the RIWP Introduction for a glossary of MEC-related terms.

18. **Comment:** RANGE RELATED MATERIAL VERSUS MEC: The problem statements derived for each UXO being investigated for “MEC” should be modified to include determining whether the anomalies are range related material of any sort, whether they be military munitions or munitions debris (whole or parts), of explosive concern or not, safe or not, wire, fencing, targets, etc. Range related material of any sort remaining on site would potentially be a source for contaminants, including MC. Delineation of all range related material is necessary and will be useful in the MC investigation. Determination of whether the material is of explosive concern or not and delineation thereof should be a separate, or subset, objective. Modify the RIWP to account for this added objective at each UXO site being investigated for MEC and/or MC and explain how it will be accomplished OR explain how it is already addressed given the language used in the RIWP (Intro, Part 1, Part 2).

Response: The problem statements presented in Part 1 (MEC SAP) Sections 10.4.4, 10.5.4, 10.6.4, 10.7.4, and 10.8.4 have been revised to replace “MEC” with “MEC/MPPEH.” In addition, the second sentence in each of these sections has been replaced with *“If present, MEC/MPPEH could pose a safety hazard to humans or be a source of MC contamination in the surrounding environmental media.”* (See also RTC 3.) It is noted that the primary objective of this RI is to establish the nature and extent of MEC/MPPEH and MC contamination associated with historical use of munitions at each of the UXO sites. Ubiquitous items such as fencing, wire, sign posts, nails, etc. are expected to be encountered during the course of fieldwork due to the multiple uses to which most of these sites have been subject. While the locations and descriptions of these items will be documented, they will not be considered “range-related debris,” as defined in NAVSEA OP-5, unless clear evidence of such is provided through markings or labels on the items. The uncertainties associated with determining whether such items are range-related will be discussed in the RI Report.

19. **Comment:** MEC TRANSECT DESIGN: Please explain the following:

a) How was the target radius determined for each UXO?

Response: The target radius was determined by examining the VSP-generated kriged density maps of SI survey data, as depicted in the Part 2 (MC SAP) Appendix D figures entitled, “Delineation of High Density Areas Greater Than 100 Anomalies Per Acre.” In general, the minimum radius among the different high-density anomaly regions was selected as the target radius for each UXO site. For UXO 4, the smallest region exhibiting a high density of anomalies had a diameter of approximately 330 feet, and was shaded purple on the VSP map (upper right corner of figure). For UXO 7, the smallest region exhibiting a high density of anomalies had a diameter of approximately 230 feet, and was shaded blue on the VSP map (left side of figure). For UXO 8, the smallest region exhibiting a high density of anomalies had a diameter of approximately 150 feet, and was shaded blue on the VSP output (bottom of figure). However, this region was not believed to be a fair representation of the actual bombing target area, which is clearly marked by metal posts in the center of the northern survey area. Rather, the geophysical anomalies in this small region are thought to be predominantly due to the accumulation of surface cultural (non-munitions) debris in vegetation along the shoreline caused by tidally influenced deposition. The target radius associated with the visible scattering of munitions-related debris is better approximated by the size of the extremely high-density anomaly area in the center of UXO 8, which measured approximately 250 feet at the smallest width (measured from top to bottom). Based on the knowledge that the use of large (100-lb) practice bombs creates a wider scattering of debris upon explosion/impact than the use of small (3- to 4-lb bombs) in UXO 7, the target radius for UXO 8 was conservatively estimated to be the same as that for UXO 7 (i.e., 230 feet) for the purpose of sampling design.

- b) How was the Background Density determined for each UXO? (Why 10?) Explain how the SI data was used from each UXO site to determine a background number of anomalies. The Draft appears to indicate a number was selected with little or no technical justification. Could the SI surface surveys be used to extrapolate a number of background anomalies per acre? Could a non-range remote area be surveyed to generate a background number? Alternatively, lacking any way to calculate a background number, applications of the VSP using different background numbers could at least generate information which could explain the significance (or insignificance) of background number on investigation design. This information should be presented to support a selection of 10 or 20 if no other specific justification can be provided.

Response: To determine the background density, kriged data were examined using the VSP-generated histogram box plots and frequency plots entitled, "Kriged Anomaly Density." At each UXO site, the composite of all areas that did not fall within any of the identified high-density anomaly areas was shaded yellow and displayed on a box plot. The portion of the non-high-density region that included the 25 to 75 percentile range of the data points on the box plot was shaded yellow, and the upper end of this interquartile range was considered an approximate threshold for background density. This threshold was between 12 and 13 anomalies per acre (ApA) for UXO 4, so background was conservatively estimated as 10 ApA. The inflection point was also confirmed on the VSP-generated plot of anomaly frequency versus anomaly density as the height breakpoint between low-density background anomalies (represented by the first tall yellow vertical bar) and the much lower height/frequency shown by the remaining yellow histogram bars. At UXOs 7 and 8, the background threshold was estimated as 20 ApA, which is indicated by the apparent inflection points on the anomaly frequency versus anomaly density plots.

- c) How was the Expected Target Area Density Above Background calculated for each UXO? (see Appendix Figures/Diagrams)

Response: The expected target area density above background was estimated by examining box plots to determine a conservative value for each high anomaly density region. In the case of UXO 4, the box plot entitled, "Kriged Anomaly Density" reveals that the green and purple high-anomaly regions are associated with median densities of 132 and 105 ApA, respectively; and the anomaly frequency versus anomaly density plot confirms that the high anomaly density colored regions consist chiefly of densities above 105 ApA, which was the value selected for target area density above background. For UXOs 7 and 8, the anomaly frequency versus anomaly density plots indicate that the high anomaly density regions consist chiefly of densities above 90 to 95 ApA, so the target area density above background was estimated to be 90 ApA for these two UXO sites.

- d) How was the Distribution Pattern of target area density determined for each UXO?

Response: The bivariate normal distribution was selected from among the two options available in VSP because this distributional shape corresponds to a decreasing density pattern with distance from the target center. The other VSP software option, a uniform density distribution, does not allow for decreases in density with distance from target center and, therefore, is not a realistic distribution pattern based on the random nature of bombing/projectile aiming errors.

20. **Comment:** INTRUSIVE INVESTIGATION INSIDE SUSPECT MEC BOUNDARIES: Review of the document generated the following questions pertaining to this portion of the investigation.

- a) How was it decided that investigation of 5 to 10 grid areas within the VSP estimated boundaries was sufficient to delineate MEC? What happens if no MEC is identified in an individual grid area within a suspect MEC area? Is the area then reclassified as a

non-MEC area? Please identify where in the document this part of the process is described and/or modify the RIWP to include it.

Response: The sixth paragraph of Part 1 (MEC SAP) Section 17.1.2.1 presents the general reasoning behind the selection of grid quantities and locations. In response to this comment, the paragraph has been revised as follows: "Representative grid locations will be selected based on an evaluation of both surface finds and geophysical data. A range of anomaly densities, distributions, and physical locations relative to the impact area boundaries will be investigated in sufficient quantities to develop representative anomaly and MEC item density distributions across the apparent impact areas. ***In addition, the grid investigation results will be used to identify the types of MEC/MPPEH present in the subsurface, confirm the maximum depth of contamination, characterize the distribution pattern (e.g., scatter and depth), and correlate geophysical response signals with specific item descriptions (e.g., type, size, depth, orientation).*** Because a single MEC/MPPEH find within a VSP-flagged impact area could support the hypothesis that the area is correctly designated as a discrete impact area, statistical significance is not a critical factor in selecting the number of grids to be investigated. It is estimated that ten grid investigations will yield sufficient data ***at this site*** to reasonably define the nature and ***localized*** extent of MEC/MPPEH contamination ***and to identify trends in spatial distribution patterns.*** However, this number may be adjusted, if necessary, during the data acquisition and evaluation process."

It is noted that the purpose of the grid investigations is not to delineate the overall horizontal boundaries of contamination, but rather to characterize the nature and localized extent of contamination within areas exhibiting high densities of anomalies that are likely due to MEC or MPPEH. This phase of the RI is not intended to exhaustively investigate every potential hotspot where MEC or MPPEH could exist, as the number of anomaly locations within each high-density region involves many data points. However, the intrusive investigation is designed to be conducted at locations that best represent the majority of MEC/MPPEH contamination within these regions. As more data are collected from the geophysical and intrusive investigations, the interim results and figures showing the locations of MEC/MPPEH and kriged density maps from the geophysical surveys will be shared with the Partnering Team for the purpose of directing further intrusive investigation and/or step-out surveys during the RI. Ultimately, the acquired data will be used in designing the approach for the feasibility study that will guide the final remedial actions at UXO areas of concern.

A finding of no MEC or MPPEH identified within a grid will be considered along with other lines of evidence in establishing the characteristics of that particular region of high anomaly density so that munitions response site boundaries can be appropriately identified and evaluated in the Hazard Assessment. In keeping with the decision rules presented in Part 1 (MEC SAP) Sections 11.1.4, 11.2.4, 11.3.4, 11.4.4, 11.5.4, and 11.6.4, if no MEC/MPPEH items are identified, possible outcomes include no further investigation or active remediation or, if there is no physical evidence of munitions use and a low likelihood of MEC/MPPEH presence, consideration by the Partnering Team for exclusion from further consideration as part of the munitions response area.

b) Explain how the 5 to 10 grids are to be selected. Please identify where in the document this part of the process is described and/or modify the RIWP to include it.

Response: See response to Comment 20a. As noted in Part 1 (MEC SAP) Section 17.1.2.1: "...Representative grid locations will be selected based on an evaluation of both surface finds and geophysical data. A range of anomaly densities, distributions, and physical locations relative to the impact area boundaries will be investigated in sufficient quantities to develop representative anomaly and MEC item density distributions across the apparent impact areas..." (Similar text is presented in Part 1 [MEC SAP] Sections 11.2.2, 11.4.2, 11.5.2, and 11.6.2.) The grid locations will be distributed across the UXO site as necessary to investigate a range of VSP-designated regions of high anomaly density, a range of anomaly distributions within the high-density regions (e.g., clustered about a single point, dispersed more uniformly throughout the area), and a range of

physical locations across the site (e.g., at the center of the site, near the site boundaries, in other parts of the site). Larger regions of high anomaly density shown on the Part 1 (MEC SAP) Appendix D VSP kriged data plots could include more than one grid to be investigated, while smaller regions will likely include only one grid investigation. The intent is not to resolve every anomaly within the high-density regions, but rather to characterize the nature and localized extent of MEC/MPPEH so that apparent correlations between the geophysical data collected for that region and the presence of MEC/MPPEH can be identified.

- c) **Modify the RIWP to require that maps of VSP generated MRS's and proposed grids to be investigated be provided to EPA and the SCDHEC for approval prior to implementation in the field.**

Response: Part 1 (MEC SAP) Worksheet #6 has been modified to include a pathway for communication regarding Partnering Team review of VSP maps of anomaly data and kriged density estimates, along with figures showing the proposed locations of grid investigations in the impacted areas. These items will be generated as soon as practicable after field data are collected for each UXO site and will be shared with the Partnering Team to provide an opportunity for review and comment on the grid locations proposed for intrusive investigation. To minimize impacts to the field schedule and budget, an expedited review (e.g., 1 or 2 days) will be requested.

- 21. **Comment:** **INTRUSIVE INVESTIGATION – NON-MEC SUSPECT AREAS / AREAS OUTSIDE THE VSP FLAGGED IMPACT AREAS (SUSPECT MEC BOUNDARIES) & STEP OUTS:** Review of the document generated the following questions pertaining to this portion of the investigation.

- a) **The Draft SAP Part 1 includes numerous references to a step-out procedure to be followed in the event munitions and explosives of concern (MEC) are discovered during the investigation process of an area expected to be Non-MEC. An example of the stated process is “Step-Out Area Investigation: A 100% geophysical investigation and intrusive investigation of suspect anomalies will be conducted within a 50-foot by 50-foot step-out area grid, centered on the location of the MEC item. The survey will be conducted using an all-metals detector to locate suspect anomalies in the subsurface soil. All newly identified suspect anomalies within the grid will be intrusively investigated to refine the boundaries of MEC contamination. Step-outs will only be conducted in grassy areas because paving interferes with the ability of geophysical instruments to detect subsurface anomalies.” While this procedure is an acceptable process for conducting the work involved, no statement is provided in the text concerning what will occur should MEC be discovered during the process (i.e., will an additional step-out procedure be conducted for MEC discovered during a step-out?). Provide this information at an appropriate location (or locations) in the Draft SAP Part 1. Modify the RIWP as necessary.**

Response: As indicated in the Process Flow Diagrams presented on Figures 17-2, 17-4, 17-6, 17-8, 17-10, and 17-12, anomalies identified during the step-out process will be intrusively investigated and, if MEC/MPPEH are identified, additional step-outs will be performed until no MEC/MPPEH items are found near the boundaries. After the step-out process is complete, VSP will be used to redefine the estimated boundaries of the target/impact area. The Worksheet #17 text corresponding to these diagrams has been revised to capture the iterative nature of the step-out process and the intent to conduct additional step-out surveys as necessary to define a “clean” boundary. In addition, the text quoted in the comment (from Part 1 [MEC SAP] Section 11.1.2) has been revised as follows: “Step-Out Area Investigation: A 100% geophysical investigation and intrusive investigation of suspect anomalies will be conducted within a 50-foot by 50-foot step-out area grid, **with the near side of the grid** centered on the location of the MEC item. The survey will be conducted using an all-metals detector to locate suspect anomalies in the subsurface soil. All newly identified suspect anomalies within the grid will be intrusively investigated to refine the

boundaries of MEC contamination. ***Additional step-outs will be conducted, as necessary, until no MEC/MPPEH are identified within 50-feet of the newly defined boundary.***

- b) Explain the apparent contradiction in the Step-out procedures whereby initially a Non-MEC suspect area only requires a “statistically derived randomly selected subset of subsurface anomalies” investigated, however, once an MEC is detected (thus making this an MEC Area) a Step Out area now requires a “100% geophysical investigation and intrusive investigation of suspect anomalies”, apparently being considered as one of the 5-10 grid areas now required for MEC Areas. However, there is no mention of the remainder of the originally “Non-MEC” area being divided into MRS areas and the remainder of the 5-10 grid areas of an MEC area. Why would this not be necessary now to delineate MEC in this newly identified MEC area? Or is the area outside the “Step-out grid” still considered Non-MEC and could be investigated by the remainder of the statistically derived randomly selected subset (substituting for the items now inside the MEC AREA) to be representative, as is the case with the areas outside a suspect flagged area? EPA recognizes this question is really a more fundamental question of the logic behind the approach and may be more easily addressed in a face-to-face meeting with a certain number of “for example” scenarios until a common understanding of the procedures is achieved and determined to be technically supported. EPA is available for such a session upon sufficient notice. Otherwise, it may be that the VSP guidance/instructions sufficiently explain this type of situation and a copy of and reference to the appropriate text would be sufficient.

Response: The plan provides for selecting a statistically-derived randomly selected subset of anomalies for verifying the absence of MEC in the low-density anomaly regions (colored yellow on the VSP mapping output), and is intended to yield 95% confidence that 95% of the anomalies found in these areas are not due to MEC. This confidence level is needed so that the focus of the RI and subsequent remedial efforts can be on the VSP-designated regions of high anomaly density. In the event that MEC is unexpectedly found within one or more of the intrusive investigations of selected anomalies within the low-density (yellow) regions, then further geophysical and intrusive investigation would be planned in order to establish the relationship between the density of anomalies and the pattern of MEC in the subsurface. For UXO 3, this additional investigation will be conducted in 50-foot by 50-foot step-out grids to maintain consistency with the 100 percent surveys conducted during the SI. For the other UXO sites, the step-out investigation designs have been revised to reflect transects (rather than grids), using the same spacing already specified in RIWP Part 1 (MEC SAP) Worksheet #17 for the respective investigation areas at each site. This revised approach will ensure that step-outs can be conducted iteratively, where necessary, to fully define the boundaries of areas impacted by MEC/MPPEH without placing undue emphasis on only certain portions of the boundaries.

- c) Please explain if the VSP Geostatistical Mapping module already included an option for identifying the area around the VSP designated impact areas (hoop or frame shaped area around)? Did the VSP Geostatistical Mapping module anticipate identification of this area as a single non-impact area?

Response: The VSP software modules used in designing this MEC investigation have been applied in a manner consistent with their use in MEC investigation designs for other Department of Defense MRP sites. The developers of VSP have tailored the software and presented training regarding appropriate application to the investigation of MEC at military munitions ranges. One aspect of the training included the designation of the area surrounding the impacted areas as a single area of non-impact, and the investigation of a statistically significant number of anomalies to support this hypothesis. The same VSP modules used to design the MEC investigation will be applied interactively throughout the RI data collection phase to incorporate additional survey data acquired during the RI and refine the Appendix D maps so that the boundaries between the impacted areas and the non-impacted “hoop” or “frame” area surrounding these areas can be established as accurately as possible.

- d) **Modify the RIWP to require that maps of VSP statistically generated anomalies proposed for intrusive investigation be provided to EPA and SCDHEC for approval prior to implementation in the field.**

Response: Part 1 (MEC SAP) Worksheet #6 has been modified to include a pathway for communication regarding Partnering Team review of VSP maps of anomaly data and kriged density estimates, along with figures showing statistically generated anomalies proposed for investigation in the non-impacted areas. These items will be generated as soon as practicable after field data are collected for each UXO site and will be shared with the Partnering Team to provide an opportunity for review and comment on the individual locations proposed for intrusive investigation. To minimize impacts to the field schedule and budget, an expedited review (e.g., 1 or 2 days) will be requested.

22. **Comment:** **AQUATIC INVESTIGATIONS:** Review of the document generated the following comments concerning aquatic investigations:

- a) **Explain why the likely most populated areas of anomaly detection in the SI were omitted from the RI MEC investigation. An investigation of these areas should be added to the RIWP unless a significant reason is provided. Modify the RIWP to address this.**

Response: The following text has been added to Part 1 (MEC SAP) Section 17.1.2.2 after the third sentence, and to Part 1 (MEC SAP) Section 17.1.4.2 after the fourth sentence: ***“The locations were selected on the basis of proximity to the central portion of the impact area where anomalies are most likely to be caused by MEC/MPPEH. Clusters of anomalies located near shorelines where cultural debris was observed during the SI will not be investigated using these techniques because the debris causes electronic and physical clutter unrelated to MEC/MPPEH that interferes with the ability to obtain discernible images through underwater photography and sonar.”*** See response to Amick Comment 15 for additional discussion on this topic.

- I) **Add an investigation of the area in the most easterly curve of the widest part of the waterway at UXO 4 where the most anomalies were detected.**

Response: See response to Comment 22a. The presence of visible construction debris in this area of the UXO 4 waterway would interfere with the ability of the planned RI investigation techniques to provide conclusive results.

- II) **Add an investigation of the waterway area in the most southwesterly corner of the range.**

Response: Assuming that this comment relates to the southwestern corner of UXO 6, see response to Comment 22a. This location contains a significant amount of visible cultural debris items (e.g., discarded soda cans and other litter), which would interfere with the ability of the planned RI investigation techniques to provide conclusive results. In addition, this location is in a Cultural Restricted area where anomalies may be due to protected artifacts from early European settlements dating back to the 1500s.

- b) **If range related materials are identified in the waterways of UXO 6 near the southern boundary, the Navy should expand the RI investigation of waterways to include navigable waters south of the range boundary, to either validate the range boundary or identify where the range boundary should be located. (Also see IDENTIFICATION OF RANGE BOUNDARIES below.) Modify the RIWP to address this.**

Response: There were no anomalies detected in the southern portion of the UXO 6 waterways other than those in the area where cultural debris was observed (see response to Comment 22a.II).

- c) The text calls for identification of a substitute anomaly when the selected anomaly cannot be reacquired within a one meter radius of the prescribed coordinates. However, it does not call for a substitute anomaly when an anomaly is tagged as being inaccessible. A substitute anomaly should be identified when one is inaccessible. Modify the RIWP to address this.

Response: The text in Part 1 (MEC SAP) Section 17.13 has been revised to call for the investigation of a substitute anomaly if the selected anomaly is inaccessible.

23. **Comment:** EXPLOSIVE SAFETY HA: Please explain the role of an “explosive safety HA”, as is called for at the end of the MEC stage of the investigation, as it relates to proceeding through the CERCLA process. Explain what “sufficient evidence of MEC/MPPEH” is with respect to requiring an explosive safety HA such that “risk can be accurately assessed.” Explain if the HA requires a certain minimum distance between transects to be able to assess a site, or if it is based on a density of MEC in an area which can be extrapolated from transects of any distance, or if it is simply based on a type of MEC found, etc. Also define “HA” and add it to the acronyms list. Modify the RIWP to address this.

Response: The last sentence of the third paragraph of the Part 1 (MEC SAP) Executive Summary has been deleted, and a new paragraph has been added to state: *“Documented evidence of MEC/MPPEH collected during the field investigations at each MRA will be used to define the boundaries of individual MRSs and conduct a MEC Hazard Assessment (HA) for each, in accordance with ‘Munitions and Explosives of Concern Hazard Assessment Methodology’ (EPA/DOD/DOI, 2010). The MEC HA process was developed to provide a framework for assessing human health and safety concerns associated with potential explosive hazards at MRSs based on an evaluation of the following three components of explosive hazard incidents: severity (potential consequences of the effect on a human receptor should a MEC item detonate), accessibility (likelihood that a human receptor will be able to come into contact with a MEC item), and sensitivity (likelihood that a human receptor will be able to interact with a MEC item such that it will detonate). The MEC HA methodology represents a standardized interagency-approved approach to evaluating MEC hazards within the regulatory framework of the MMRP and CERCLA, and allows for an evaluation of baseline explosive hazards, as well as relative hazard reductions associated with remedial alternatives to be evaluated in the Feasibility Study (FS).”*

24. **Comment:** MEC DECISION RULES: It should be noted that EPA considers the decision rules proposed in the Draft SAP Part 1 as only applying to the MEC investigation phase of the RI. Data regarding delineation of range related materials will be used in the MC Phase of the investigation, which may result in a need for remediation of sites even if no MEC is identified and/or if no remediation of MEC is necessary for safety purposes. Any mention in the document regarding proceeding to an FS would be with respect to MEC only, but the MC investigation must still proceed if range related materials are found to be present.

Response: This is consistent with the Navy’s intent for the RI and is the reason that default sampling locations are specified in Part 2 (MC SAP) Worksheet #17. To clarify, the analytic approaches presented in Part 1 (MEC SAP) Sections 11.1.4, 11.2.4, 11.3.4, 11.4.4, 11.5.4, and 11.6.4 have been revised to state that these decision rules apply to the MEC investigation, and the following text has been added to the end of each section: *“Note: the MC investigation described in the MC SAP will proceed as planned regardless of the outcome of the MEC investigation.”*

25. **Comment:** VERIFICATION OF RANGE BOUNDARIES: The Draft SAP Part 1 describes areas to be investigated just outside some of the UXO boundaries, but not all, and not along all

points of the boundary. Although the draft describes investigation of anomalies within 50 feet of a survey area and what will happen if MEC is identified, the draft does not explain what will happen if these areas are found to contain range related materials. Will surveys/step-outs be performed until a clean edge is located? Will areas to be investigated be added outside of UXO boundary lines if range related materials are found in high concentrations at or near range boundaries? This gets to delineation of any range related materials left on site. Please explain and modify the RIWP as necessary. (Comment based on inconsistent use of "MEC")

Response: See response to Comments 21a and 21b.

26. **Comment:** IDENTIFICATION OF RANGE BOUNDARIES: Some issues were noted that require correction and/or an expanded discussion to provide additional details concerning the basis for the information provided in the documents. The Draft SAP Part 1 does not adequately present the basis for apparently limiting the distance for projectiles fired on the two artillery ranges Unexploded Ordnance Sites (UXO) 4, and UXO 5 and 6, to the distances provided in Table 10-1, Summary of Munitions Response Sites. For example, the impact area for UXO 4 is presented in the table to be 8,000 feet (2,438 meters) in length and the firing fan is 17,000 feet (5,182 meters) long. However, the weapons fired there included the M1897 75-millimeter (mm) gun and the M1 75-mm pack howitzer. Assuming that high explosives-loaded rounds were fired, the M1897 75-mm gun had a maximum range of approximately 6,364 meters firing the reduced propellant charge (12,758 meters with the super charge). The M1 75-mm pack howitzer had a maximum range of approximately 8,787 meters firing propellant charge 4 (the maximum charge) and approximately 3,831 meters firing charge 1 (the minimum charge). All of these maximum ranges exceed the length of the firing fan and the length of the identified impact area. As a further complication, when the firing elevation of these weapons is reduced from the gun/howitzer tube elevations required to achieve these maximum ranges, the potential for a projectile to ricochet upon impact increases. The elevations required to keep the impacts inside the length of the range fans/impact areas would have resulted in an increasing number of ricochets as it approached the 300 mils likely ricochet elevation and the 75 percent ricochet elevation of approximately 200 mils. While an unexploded ricochet will not necessarily travel to the maximum range, it can come very close to that distance under ideal conditions. Also, though less likely than a ricochet, the potential for the range fans to have been exceeded due to gunnery errors cannot be discounted without discussion of the reasons for doing so. Similar issues were noted at the combination UXO 5 and 6 with the overall length of the range fan being approximately 3,658 meters and the weapon maximum range 8,924 meters with the unadjustable fixed charge. The basis for not extending the potential impact area out to the maximum range of the weapon/round combinations fired at the respective ranges should be documented or a reference to where this information may be found should be provided in the Draft SAP Part 1.

Response: The initial limits of the RI investigation impact area boundaries coincide with the site boundaries delineated in the ASR/RIPRA. As provided for in the step-out process (and revisions to the process discussed in response to Comment 25), these boundaries may be adjusted outward, if necessary, based on results of the RI as dictated by the discovery of MEC/MPPEH items. While the Navy agrees that the currently estimated UXO 4 and UXO 6 boundaries do not extend to the maximum theoretical range of the 75-mm munitions, the RI is designed to address the areas most likely to have received projectiles based on the documented range layouts, expanding outward where necessary as new information becomes available. This dynamic work strategy is based on EPA's Triad approach to evaluating sites, and will allow the Navy to focus its resources in areas where the explosive hazard is likely to be the greatest while providing flexibility to investigate additional areas as dictated by the investigation results.

27. **Comment:** TERMINOLOGY: The Draft SAP Part 1 includes a number of terms in the discussion of exclusion zones in SAP Worksheet #17, Sample Design and Rationale, Section

17.2.2, Site Accessibility and Exclusion Zones, that require explanation. Examples of these terms include, but are not limited to:

- a) “K40 of the MGFD”: While munition with the greatest fragmentation distance (MGFD) is defined in the Acronyms section, K40 is not. The same is true for K328 and K18 found in Table 17-1, Controlling EZs for Each UXO Site’s Primary MGFD. The meaning of the K, the numbers following the K, and why these combinations are used including how they are calculated should all be explained.
- b) “K40 and K328 of the MGFD are greater than the HFD and MFD of zero feet”: It is unclear as to what is referred to as having the hazardous fragment distance (HFD) and maximum fragmentation distance (MFD) of zero feet.
- c) “Calculated using $D=K \times 3/W$ calculation obtained from Naval Sea Systems Command (NAVSEA) OP 5 Vol 1”: Unexplained items here include D, K, W, and the identity of “OP 5 Vol 1.”
- d) “Mechanized Low Input Operations”: This term is not defined.

Review the cited issues noted above and revise the Draft SAP Part 1 to eliminate the concerns noted and define the terms as necessary to promote clarity in the document.

Response: The MEC-related terms mentioned in Part 1 (MEC SAP) Section 17.2.2 have been defined in the text or table and added to the Part 1 (MEC SAP) list of Acronyms. Additional revisions to Section 17.2.2 and Table 17-1 are as follows:

- a) The meaning of the K18, K40, and K328 overpressure distances have been explained in the text.
- b) The table footnote has been revised to state: ***“K40 of the MGFD is used because these items are non-fragmenting and do not have an associated HFD or MFD.”***
- c) Table footnotes have been revised or added to define D, K, and W, and to correct the reference citation for OP 5.
- d) A table footnote has been added to describe Mechanized Low Input Operations.

III. SPECIFIC COMMENTS – PART 1 MEC

28. **Comment:** Draft SAP Part 1, Acronyms, Pages 4-6 of 182

The following acronyms in the Draft SAP Part 1 have issues and require correction as noted:

- **AFT:** This acronym is incorrect and should read “ATF”. It is also misidentified as “Alcohol, Tobacco, and Firearms.” ATF is the current acronym for the Bureau of Alcohol, Tobacco, Firearms and Explosives per ATF Publication 5400.7 (Federal Explosives Law and Regulations).
- **BATFE:** This unofficial acronym is often used in place of the official acronym “ATF” for the Bureau of Alcohol, Tobacco, Firearms and Explosives. It should not be used in the Draft SAP Part 1.
- **DDESB:** The correct definition is the Department of Defense Explosives Safety Board per DoD 6055.09-M-V8.

- **ESQD:** The correct definition is Explosives Safety Quantity-Distance per DoD 6055.09-M-V8.
- **HFD:** The correct definition is Hazardous Fragment Distance per DoD 6055.09-M-V8.

Correct the definitions of the noted acronyms as stated above. Also, correct any uses of the incorrect terms/definitions throughout the Draft SAP Part 1.

Response: The noted errors have been corrected in the Part 1 (MEC SAP) List of Acronyms and in the text upon first use of the terms.

29. **Comment:** Draft SAP Part 1, SAP Amendments, Pages 21 of 182

Please modify the RIWP to indicate any amendments to the approved SAP require EPA and SCDHEC approval.

Response: Part 1 (MEC SAP) Worksheet # 6 has been revised to state that any proposed amendments to the approved SAP will be submitted to EPA and SCDHEC for review and approval.

30. **Comment:** Draft SAP Part 1, SAP Worksheet #10, Conceptual Site Model, Section 10.5.3.1, Potential or Known Sources of MEC, Page 46 of 182

Section 10.5.3.1 of SAP Worksheet #10 notes in the second paragraph on Page 46 of 182 that “As indicated in the RIPRA table below, maximum penetration depths for complete rounds of these munitions are estimated to be between 5 and 10 feet bgs (USACE, 1999b).” The term “complete round” should not be used to describe a fired projectile. A “complete round” (also referred to as a “round” or a “round of ammunition”) is all of the components required to fire the associated weapon once. In general, these components are primer, propellant, container or holder for propellant (cartridge case or bag), and projectile—with fuze and booster if necessary—for the proper functioning of the projectile. A fired projectile is not a round, as the components required to propel it downrange were either consumed or left behind at the firing site (i.e., propellant, cartridge case or bag, primer). Correct this misuse of the term “round” in Section 10.5.3.1 and elsewhere in the Draft SAP Part 1 where it is used to refer to a fired projectile (or a projectile separated from the components required making it a round).

Response: The misuse of the term “round” has been corrected where necessary.

31. **Comment:** Draft SAP Part 1, SAP Worksheet #17, Sample Design and Rational, Section 17.2.2, Site Accessibility and Exclusion Zones, Pages 106 of 182 and 107 of 182

Section 17.2.2 of SAP Worksheet #17 states that “If non-project personnel or non-essential non-UXO personnel enter an EZ, MEC operations will cease until the EZ is re-established. EZs are intended to keep non-essential personnel from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation.” It is unclear as to why there is a discriminator of “non-UXO personnel” attached to the term “non-essential.” This would seem to indicate that non-essential personnel who are UXO personnel can be allowed to enter the exclusion zone (EZ) during MEC operations. Review the noted sentences and correct them to eliminate the perceived discrepancy.

Response: The first sentence of Part 1 (MEC SAP) Section 17.2.2 has been revised to state: *“If non-essential personnel enter an EZ, MEC operations will cease until the EZ is re-established.”*

32. **Comment:** Draft SAP Part 1, SAP Worksheet #17, Sample Design and Rational, Section 17.12, Intrusive Investigation - Manual and Mechanized Low Input, Page 123 of 182

The third paragraph of Section 17.12 in SAP Worksheet #17 states that “Each intrusive dig team will consist of two qualified UXO personnel, with at least one being a UXO Technician II or higher.” The term “qualified UXO personnel” includes all individuals listed in DDESB Technical Paper 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, if they are qualified to perform the listed functions of the identified position they fill. This includes UXO-Sweep Personnel and UXO Technician I individuals, who are not UXO-Qualified Personnel. It is unclear if this is the intent of the statement.

If the intrusive dig team is to consist of UXO Technicians, this should be stated. If all of the persons on the dig team are to be UXO-Qualified Technicians (i.e., UXO Technician II or higher), this should be stated. Revise the cited sentence to specifically identify the composition of the intrusive dig team.

Response: The first sentence of the third paragraph of Part 1 (MEC SAP) Section 17.12 has been revised to state: *“Each intrusive dig team will consist of two UXO technicians, with at least one being a UXO Technician II or higher.”*

33. **Comment:** Draft SAP Part 1, SAP Worksheet #17, Sample Design and Rational, Section 17.14.1, MEC (Storage), Page 125 of 182

The second paragraph of Section 17.14.1 of SAP Worksheet #17 states that “MEC and MEC-related items will be transported to the storage magazine by the end of each work day.” It is unclear what is intended by the use of the term “MEC-related items.” Define this term or replace it with other terminology that is a standard term defined elsewhere in this document, or in other official documents that may be referenced.

Response: Comprehensive changes have been made to all Part 1 (MEC SAP) Section 17.14 subsections to reflect a revised plan for MEC management. (See response to Amick Comment 13.) The revised text focuses on the management of MEC and MDEH, and does not use the term “MEC-related items.”

34. **Comment:** Draft SAP Part 1, SAP Worksheet #17, Sample Design and Rational, Section 17.15.3, MPPEH Management (Disposal), Page 132 of 182

The third paragraph of Section 17.15.3 of SAP Worksheet #17 references “OP 5 Change 8” as containing the detailed guidance on Material Potentially Presenting an Explosive Hazard (MPPEH) disposal and disposition procedures. Change 9 to OP 5 is dated 1 July 2010 and contains a number of revisions involving MPPEH and associated processing. Correct the reference as noted in the listed section and in the References section on Page 181 of 182 and correct any procedures found in the Draft SAP Part 1 and its attached documents as required by this change.

Response: Since this comment was written, Change 10 to OP-5 has been issued. Thus, the second sentence of Part 1 (MEC SAP) Section 17.15.3 and the Part 1 (MEC SAP) Reference section have been revised to refer the reader to *“OP 5 Change 10 (2011)”* rather than “OP 5 Change 8 (2009).”

IV. GENERAL COMMENTS – PART 2 MC

The Draft Sampling and Analysis Plan, Munitions Response Program Part 2: Munitions Constituents Remedial Investigation at Unexploded Ordnance Sites 2, 3, 4, 5, 6, 7, and 8 dated September 2011 (Draft SAP Part 2) was reviewed and generated the following comments pertaining to the RIWP:

35. **Comment:** GLOBAL CHANGES: See comments on Introduction and/or Part 1 which may require changes to Draft SAP Part 2 as well.

Response: Changes made in response to comments have been made throughout the entire document to ensure consistency.

36. **Comment:** ENDANGERED, THREATENED, OR POTENTIALLY PROPOSED SPECIES: Please clarify if any of the UXO Sites contain habitat which would be used by any of the species listed in the SI Report, especially those known to inhabit Beaufort County, including migratory species. If so, modify the RIWP to consider these as potential receptors. (Also see Sitewide ERA in INTRO General Comments above.)

Response: See response to Comment 13.

37. **Comment:** MEC, ETC.: Please include a brief explanation of the munitions related terminology as used in the Part 2 document. Modify the RIWP to include this and/or reference it.

Response: The RIWP Introduction has been revised to include a glossary of MEC-related terms, as defined in NAVSEA OP-5, Volume 1, Seventh Revision, Change 10. In addition, the second paragraph of the Part 2 (MC SAP) Executive Summary has been revised to refer the reader to the RIWP Introduction for a glossary of MEC-related terms.

38. **Comment:** MC SAMPLING IS NOT OPTIONAL: Any mention in the document regarding not taking samples if MEC is not present is not acceptable to EPA. The MC investigation must still proceed if range related materials are found to be present or if historical use has been documented and not disputed with no indication of a range clearance being performed. It is EPA's understanding that range related materials have been identified on UXOs 2, 3 (historically and likely in the RI Part 1), 4, 7 (archeological digs), and 8. Some of the UXO 6 anomalies may or may not be found to be range related in the RI Part 1. However, historical records indicate the use of UXO 6 as a range and no record of a range clearance being performed was presented to EPA when previously requested. The potential impact from MC should be investigated whether or not the Navy can locate the historical spent rounds and/or debris. Therefore EPA considers an MC investigation to be required at these UXOs. UXO 5 might have been the only UXO for which the Navy could make an argument for no MC investigation, since its location is questionable; however, in the RIWP the Navy has already made an acceptable argument for MC samples. The RIWP should be modified accordingly.

Response: The Part 2 (MC SAP) Worksheet #17 specifies that soil sampling will be conducted at default locations if no MEC/MPPEH are encountered during the RI either where surficial MEC/MPPEH items were encountered during the SI (UXO 4) or at prescribed non-biased locations (UXOs 3, 5, 7, and 8). Thus, all sites other than UXO 6 will be subject to MC sampling regardless of whether MEC/MPPEH are identified during the MEC investigation. MC samples will be collected at UXO 6 only if MEC/MPPEH items are encountered during the MEC investigation. No default MC sampling locations are planned for UXO 6 because the land areas designated for MEC investigation either: were already subject to MC sampling during the SI and found to contain no contaminant concentrations greater than screening levels, or are located outside the UXO 6 site boundary and are being investigated only to confirm that the shoreline beyond the western boundary has not been impacted by artillery operations in the marsh. Any evidence of MEC or MPPEH related to range use, however, will provide a basis for the collection of MC samples. Text has been added to the second paragraph of Part 2 (MC SAP) Section 17.4 to clarify this reasoning.

39. **Comment:** UXO 2: See General Comments for Introduction Manual. Be sure to add UXO 2 to MC sections pertaining to sediment and soil samples. Modify the RIWP Part 2.

Response: The plan for MC sampling at UXO 2 is described in the Expanded SI Work Plan to be submitted under separate cover (see response to Comment 11). Text has been revised to reflect the additional sampling in the RIWP (e.g., Introduction Pages 2-3, and Part 2 [MC SAP] Sections 10.4.2 and 11.1).

40. **Comment: CONCEPTUAL SITE MODELS (CSMs):** The following comments were generated regarding information contained in the CSMs for each UXO.

- a) **UXO 3, 7, 8 – While an argument is made that metals are the only MC of concern at the site, a subset of samples from each media sampled should be analyzed for all UXO 3 related contaminants to validate the logic for elimination from concern. Modify the RIWP to address this accordingly.**

Response: The RIWP already includes the investigation of all MC associated with the practice bombs used at UXO 3, 7, and 8 (see munitions specifications sheets presented in Part 2 [MC SAP] Appendix C) that present potential human health or ecological risks. However, to confirm that no explosive compounds are present at these sites, the following samples have been added to the sampling approach presented in Part 2 (MC SAP) Worksheets #11, 17, and 18:

- One 12-point composite surface soil sample from UXO 3
- One 12-point composite subsurface soil sample from UXO 3
- One 12-point composite surface soil sample from UXO 7
- One 12-point composite subsurface soil sample from UXO 7
- One 12-point composite shallow surface sediment sample from UXO 8
- One 12-point composite deep surface sediment sample from UXO 8

These composite samples will be collected using aliquots from the metals sampling locations shown on the Worksheet #17 figures for these sites.

- b) **UXO 3, 4, 5, 6 – The results for the analysis of explosives should have been provided even if none were “detected”. A review of detection limits to determine appropriateness is necessary. Please provide a lab report indicating such results and information regarding effective limits as compared to the PAL.**

Response: Validated analytical results for explosives in surface soil samples are provided in the SI Report Appendix H tables. These tables also contain the detection limits achieved by the laboratory and the screening levels that were used in the SI risk screening evaluation. As shown in the data tables, no explosives were detected in any of the samples collected, and the detection limits achieved were several orders of magnitude lower than the respective screening levels for each explosive compound. No further evaluation of the SI data with respect to detection limits is deemed necessary.

- c) **UXO 4 and 5 firing point locations – Please clarify if MC associated with the firing of the artillery was analyzed for at the firing points in the SI and/or planned for in the RI.**

Response: MC sampling was conducted previously during the SI to evaluate the possible presence of explosives and metals at UXO 4 Firing Points A, B, C, D, E, and R and at UXO 5 Firing Point T. Table INT-1 of the RIWP Introduction has been modified to include additional details of the sampling conducted. In addition, the discretionary samples to be collected at locations of MEC/MPPEH finds at the firing points will be analyzed for metals and explosives during the RI. (See response to Amick Comment 15.)

- d) **UXO 4 – The application of XRF biasing of samples and the associated grid sampling in the SI were not accepted by EPA as sufficient for an SI, or to rule out any areas from MC consideration; therefore, no areas are exempted and additional samples will be necessary in the RI.**

Response: The RIWP sampling approach does not rely on any of the XRF sample data from the SI nor does it specify the collection of additional XRF data.

- e) UXO 4, 6 – See general comments above pertaining to large carnivorous birds as they relate to ecological receptors. Modify the RIWP accordingly.

Response: See response to Comment 12.

- f) UXO 2, 3, 4, 6, 7, 8 – See general comments above pertaining to endangered species as they relate to ecological receptors. Modify the RIWP accordingly.

Response: See response to Comment 13.

- g) UXO 2, 4, 6, 7, 8 – See general comment above pertaining to sitewide eco risk assessment. Modify the RIWP accordingly.

Response: See response to Comment 12.

41. **Comment:** **DECISION RULES:** Decision Rule #3 should perhaps be modified to address concentrations less than PALs separately from concentrations less than the LOQs in cases where the LOQ is higher than the PAL. In the first case, the decision rule is accurate. However, in the second case, it may be inappropriate to state there is no unacceptable risk. Rather, a statement could be made that uncertainties associated with the investigation could be discussed and a decision to recommend no further action or investigation will be considered by the Partnering Team. Modify the RIWP.

Response: Decision Rule #3 presented in Part 2 (MC SAP) Worksheet #11 has been revised to include the statement: *“In cases where target analytes have risk-based PALs that are lower than the LOQs achievable by the laboratory in an environmental medium, the uncertainties associated with the results of the investigation will be discussed in the RI Report, and a decision to recommend no further action or investigation with respect to those analytes will be considered by the Partnering Team.”* A similar change has been made to Decision Rule #1.

42. **Comment:** **PROPOSED MC SAMPLING AND ANALYSIS:** Please explain the following:

- a) All UXOs – See below for questions pertaining to the number of samples.

Response: Part 2 (MC SAP) has been revised to reflect comment-specific responses, as described below.

- b) UXO 3 – Please consider whether adding one IS sample at UXO 3 would be beneficial.

Response: To confirm the presence or absence of explosives contamination at UXO 3, Part 2 (MC SAP) Section 17.1 has been revised to include the collection of 12-point composite samples for explosives analysis. One aliquot from each of the twelve discrete surface soil samples (from 0 to 1 foot bgs) planned for collection for metals analysis will be combined into one composite sample and analyzed for explosives, and one aliquot from each of the twelve discrete subsurface soil samples (from 1 to 3 foot bgs) planned for collection for metals analysis will be combined into a second composite sample and analyzed for explosives. Similar composite samples will be collected at UXO 7 and UXO 8 for explosive analysis, as reflected in the revised text in Part 2 (MC SAP) Sections 17.5 and 17.6.

- c) UXO 4 and 5 – Please explain the decision to use different sampling approaches for firing points in UXO 4 versus UXO 5.

Response: The sampling approaches are different because each firing point has different types of data gaps. For example, at UXO 5, it is believed that the Firing Point T location investigated during the SI may have been misinterpreted from historical site documents. Therefore, an investigation that includes detector-aided surface surveys, geophysical subsurface surveys, intrusive investigation of anomalies, and MC sampling will be conducted at a revised firing point location. At this revised location, one IS sample will be collected for explosives analysis, and discretionary grab samples will be collected for metals and explosives analysis at biased locations if and where MEC/MPPEH are discovered. Because IS was previously conducted for explosives at the UXO 4 firing points (A, B, C, D, E, and R) during the SI, it is not necessary to collect IS samples at these locations during the RI. Rather, the RI sampling planned for the UXO 4 firing points is focused on delineating the lead exceedance observed during the SI at Firing Point C and collecting discretionary grab samples for metals and explosives analysis at biased locations if and where MEC/MPPEH are discovered during the RI geophysical surveys and subsequent intrusive investigation of anomalies.

- d) UXO 4 and 5 – According to USACE guidance, firing points are often areas of explosives contamination (propellants). Analysis of samples at UXO firing points (including firing point C) should include associated explosives (propellants) in addition to metals and should not be limited to areas of lead exceedances in the SI. Modify the RIWP.**

Response: As reflected in the revised RIWP Introduction Table INT-1 (see response to Comment 6), IS was conducted at each of the firing points investigated during the SI (Firing Points A, B, C, D, E, and R at UXO 4, and firing point T at UXO 5) to evaluate the potential presence of explosives in surface soil. The explosives analyte list shown in the revised RIWP Table INT-1 includes propellants that are constituents of the munitions used at these sites, as identified on the munitions specifications sheets included in Part 2 (MC SAP) Appendix C. An IS sample for explosives analysis will be collected at the revised UXO 5 firing point location during the RI; however, as discussed with EPA on 12/20/11, no additional IS is necessary at the UXO 4 firing points.

- e) UXO 4 and 5 – Since propellants are not necessarily associated with presence of MEC or range related debris/materials, a biased approach of limited sampling in the SI was not sufficient to rule out the presence of propellants. According to the USACE guidance, incremental sampling should have been used at firing points to detect propellants. (at all of 4 and 5 SI areas) Modify the RIWP.**

Response: See response to Comment 42d.

- f) UXO 4 and 5 – Since propellants and other metals were not analyzed for in the SI, and because propellants are not necessarily associated with the presence of MEC or range related debris/materials, the sampling of all firing points at UXO 4 should occur regardless of whether MEC is present or not. Modify the RIWP.**

Response: See response to Comment 42d.

- g) UXO 4 and 5 – At least one gw sample should be included for detection of propellants and other MC at firing points. The Navy may wish to wait for soil sample results to make an argument against the need for a groundwater sample. Modify the RIWP.**

Response: One of the groundwater sampling locations planned for UXO 4 is in the vicinity of Firing Points C and D. This location was selected considering the lead PAL exceedance observed in the surface soil near Firing Point C and the proximity of both firing points to an existing housing area. All groundwater samples will be analyzed for metals and explosives. The need for additional groundwater sampling will be evaluated and discussed with the Partnering Team after the RI analytical results are known. Recommendations will be included in the RI Report.

- h) **UXO 4 – The location of groundwater samples at the border of the range have not yet been determined to be in MEC areas. Is there a contingency in the RIWP for moving these gw samples if the additional surveys do not reveal anomalies? The RIWP may need to be modified.**

Response: As discussed in Part 2 (MC SAP) Section 17.2, four of the six temporary monitoring wells planned at UXO 4 are located where future development has the potential to result in groundwater exposure to residents, construction workers, and/or recreational users. These monitoring well locations are near the officer's housing area (TW01), the former trailer park (TW02), Elliot's Beach (TW04), and the golf course (TW06). The other two monitoring wells are located in wooded areas near the airfield runways. The six monitoring well locations have been selected to ensure that the groundwater data generated provides information regarding site-related contaminant concentrations and general flow direction, with a focus on areas where groundwater is most likely to be encountered, not necessarily in areas where high concentrations of MEC may be found. However, to provide flexibility, a sentence has been added to end of the first paragraph in the Impact Area section of Section 17.2 to state: ***"These locations may be revised based on the results of the MEC investigation and subsequent discussions with the Partnering Team."***

- i) **UXO 4 and 6 – Groundwater samples may be necessary within the impact areas of UXO 4 and at the western border of UXO 6 (if MEC), other than just the outside borders of UXO 4. The Navy may plan for those now or wait in case an argument can be made they are not necessary. Modify the RIWP as necessary.**

Response: The need for additional groundwater sampling will be evaluated and discussed with the Partnering Team after the planned RI analytical results are known. Recommendations will be included in the RI Report.

- j) **UXO 4 and 6 – Sediments just off from the upland areas may be impacted by contaminants which have migrated. Explain why sediment samples are not necessary in areas other than the surveyed waterways, especially accessible sediment just off the upland areas of highly concentrated MEC. Otherwise, modify the RIWP to add sediment samples just off the most highly concentrated upland MEC areas once that has been determined. Modify the RIWP.**

Response: As indicated in the revisions to RIWP Introduction Table INT-1, soil and sediment samples were collected for lead and explosives analysis during the SI at biased locations of UXOs 4 and 6 other than the waterways. Explosives were not detected in any of the samples (including the land-based sediment samples), and all lead detections in samples other than the one soil sample at Firing Point C were less than screening levels. However, to verify that no MC are present and migrating from the upland areas to the waterways, Part 2 (MC SAP) Worksheets #11, 17, and 18 have been revised to incorporate the collection of additional land-based sediment samples at both UXOs 4 and 6, at discretionary locations near surficial MEC/MPPEH items that are discovered during the detector-aided surface surveys. Up to ten discretionary sediment samples each, from UXOs 4 and 6, will be collected from 0 to 6 inches bgs at locations where surface runoff from areas containing MEC/MPPEH is entering adjacent waterways. If no MEC or MPPEH are identified, then these sediment samples will not be collected.

- k) **UXO 4 and 6 – Please explain where in the waterways the SI sediment samples were taken. Describe the method used for determining where to take the samples. If these samples were only taken at depth, where anomalies were located, the lower energy sediments where contaminants which were released more broadly on impact and explosion at the surface would likely have settled would not be represented. Based on the response to this question, additional sediment samples are likely necessary at the edge of the navigable waterways. Modify the RIWP if needed.**

Response: During the SI, waterway sediment samples were collected from approximately the middle of the waterway, equidistant from each shore. Samples were collected using a petit Ponar dredge, and the top 6 inches of submerged sediment was sampled. Anomaly avoidance was practiced during the SI; therefore, samples were not collected at the exact locations of anomalies. At UXO 4, sediment samples were distributed throughout the waterways, with a bias toward areas where sediments would tend to accumulate due to slower-moving water (e.g., at bends in the waterways). At UXO 6, sediment samples were distributed throughout the waterways.

Additional sediment samples are planned for collection from the waterways of UXOs 4 and 6 during the RI, at discretionary locations dictated by the discovery of MEC/MPPEH during the underwater investigation. If underwater MEC/MPPEH are identified during the aquatic investigation, up to ten sediment samples will be collected from the top 6 inches of submerged sediment for metals and explosives analysis. To include the option of collecting sediment samples from the edges of the waterways, where appropriate, Part 2 (MC SAP) Sections 17.2 and 17.4 have been revised to state: "If underwater MEC is identified during the aquatic investigation, up to ten sediment samples will be collected from the top 6 inches of sediment lying on the bottom of the waterways **or from the edge of the waterway in cases where the item is found within 6 feet of solid ground.**"

- l) UXO 7 – All of the default sample locations are within the central target area which has not yet been investigated for MEC and does not appear to have as highly concentrated number of anomalies. The RIWP does not apparently address any sampling in the areas of the more concentrated anomalies to the sides of the original target area, and only a few are planned for the newly surveyed areas. It has been discussed that MEC could have been moved during construction of the golf course. The RIWP needs to address additional samples in these other more highly concentrated anomaly areas and potentially the newly surveyed areas if there are anomalies in order to delineate MC. Modify the RIWP.**

Response: Soil samples are planned for collection at UXO 7 from biased locations where MEC or MPPEH items are identified during the intrusive investigation of anomalies or, if none are identified, then the samples will be collected from default sample locations. To address EPA's concern regarding whether the samples at UXO 7 will ultimately be collected in areas exhibiting high concentrations of anomalies, the default locations shown on Part 2 (MC SAP) Figure 17-7 have been revised to spread the area of coverage outward to include locations east, west, north, and south of the original target area.

- m) UXO 8 – There appears to be another highly concentrated anomaly area in the far southwest portion of the original target area (pre SI). Samples should be added for this area to delineate MC. Modify the RIWP.**

Response: At UXO 8, sediment samples are planned for collection at locations where surface accumulations of practice bomb fragments have been identified. To ensure full site coverage, samples are planned for collection at or near the default sample locations. One default sample location has been revised, as shown on Part 2 (MC SAP) Figure 17-8. Sample X8SD110 has been moved into the area of concentrated anomalies identified during the SI in the southwest corner of the original target area. Sediment samples will be collected at this location from depths of 0 to 6 inches bgs and 6 to 24 inches bgs.

- n) Any changes to sample locations (generally) or any addition of sample locations determined to be necessary after this plan is approved needs approval by the regulators. The Navy should provide updated Worksheet 17 Figures as appropriate for review and approval.**

Response: RI samples have been added and/or moved at some UXO sites in response to these comments. Worksheets #11, 17, and 18 and the corresponding figures have been revised accordingly. Future changes to sample locations, if any, will be depicted on subsequent figure

revisions and transmitted to the Partnering Team for review and approval prior to sampling, as described in the revised Part 2 (MC SAP) Worksheet #6.

43. **Comment:** NUMBERS OF DISCRETE MC SAMPLES PER SITE: Please explain how the number of discrete samples required at each UXO site was determined? How are those numbers expected to delineate such large areas? Describe any statistical basis there was to the decisions.

Response: Quantities of sample locations were selected to ensure that sufficient data would be generated to calculate defensible exposure point concentrations (EPC) for contaminants of potential concern at each site. As indicated in Part 2 (MC SAP) Worksheet #9 (Internal Project Scoping Meeting), the number of samples necessary to calculate the EPC is 12 to 15 for the human health risk assessment (where the EPC is represented by the 95% upper confidence limit about the mean of the data set) and 7 to 10 for the ecological risk assessment (where the EPC is represented by the arithmetic mean of the data set).

The Navy agrees that if the purpose of the MC investigation were to delineate large areas of contamination (i.e., if no MEC investigation were being planned to guide and focus the MC investigation), then larger quantities of samples would likely be required, particularly at UXO 4. However, the large-scale delineation of site boundaries will be accomplished through the collection of field data under the MEC investigation described in Part 1 (MEC SAP), allowing the MC investigation to focus on the evaluation of chemical contamination in the immediate vicinity of MEC/MPPEH items discovered during the MEC investigation. The intent is for the MC sampling to be biased toward areas most likely to be impacted by contamination from historical range operations so that worst-case conditions can be evaluated. Additional samples could be collected at locations not associated with MEC or MPPEH, but the data obtained would likely dilute the results of the risk assessments and potentially unacceptable risks could be overlooked. The need for additional samples will be evaluated and discussed with the Partnering Team after the RI analytical results are known. Recommendations will be presented in the RI Report.

44. **Comment:** MC SAMPLING – BIASED SAMPLING VERSUS PHASED APPROACH TO COMPREHENSIVE INCREMENTAL SAMPLING: The MC stage of the investigation is proposed to be conducted interactively with the MEC, using the MEC location to locate biased sample locations for MC. While biased sampling is often an accepted approach to sampling, EPA is concerned with the less implementation/attempt to co-locate samples with MEC and/or to bias samples with lead XRF results in the SI, as well as the limited sample set being proposed to represent such large areas for MC contamination delineation. While at first it seems reasonable that MC would be located near an existing identified MEC, it may or may not be the worst case concentration or it may not be representative of the exposure unit overall. MC could have been deposited anywhere projectiles landed, exploded, and eroded, potentially leaving no current day evidence of its location. Or it could be that MC is only in the locations of the evident MEC, but not in the areas immediately adjacent. Either way biased sampling could skew the results in either direction. A more comprehensive sampling scheme, using grids and incremental sampling (to control costs), would likely give a more representative result for these large areas. For large areas, this approach is often implemented in phases (see US COE, Interim Guidance 09-02, Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program, 2009.) However, this approach may not be easily implemented until the area has been cleared of MEC explosive concerns. For this reason, EPA is willing to wait and see where this investigation leads the Navy and what delineation results reveal for MEC and MC, before making a final decision about MC. This is consistent with MC Decision Rule #2 and the Performance Acceptance Criteria, with the exception of data simply being collected as planned determining “completeness”. Therefore, EPA suggests the Navy prepare for (and allow for in the RIWP) a more comprehensive additional phase of MC investigation which would be conducted after the “MEC/MC” investigation is completed, results have been presented, and impacted areas

identified, in case delineation is determined to be insufficient. If delineation is determined to be sufficient, the additional sampling would not be necessary.

The Navy may decide whether to design this additional phase of investigation now in this RIWP in case it is needed or defer design of the investigation to an RI Addendum which might not be necessary if delineation results are determined to be sufficient. EPA prefers to at least wait for the MEC investigation results before proceeding with design. The COE document also mentions that researchers at CRREL have identified energetic contaminant release patterns and sampling protocols for a number of common range types. Specific examples are presented by CRREL (2005, 2007). The guidance goes on to state that other contaminant types (e.g. metals) may have different release mechanisms or fate and transport characteristics that would need to be considered for determining their likely spatial distribution. All of this information would be useful in designing an incremental sampling phased approach.

Response: As presented in the revised RIWP Introduction Table INT-1 and discussed with EPA on 12/20/11, IS sampling was conducted for explosive compounds during the SI at the UXO 4 firing points and eight biased locations in the UXO 4 impact area, as well as at the presumed location of the UXO 5 firing point, and no detections of explosives were reported. (See also response to Comments 6 and 42.)

The focus on collecting samples from biased locations within the impact areas (i.e., at locations where evidence of low-order detonations is observed and MEC or MPPEH is present) is consistent with CRREL TR-07-10 (July 2007), which states that, "Low-order detonations and ruptured rounds result in the largest source of energetic residues at artillery ranges," and that, "the results of low-order detonations often exist as distributed point sources of very high concentrations of residues..." Thus, sample collection is planned for the RI to characterize the biased locations or to obtain data at default locations if no MEC or MPPEH is discovered during the intrusive investigation of anomalies. To address EPA's desire to see additional IS sampling in the impact areas, Worksheets #11, 17, and 18 of Part 2 (MC SAP) have been revised to incorporate discretionary IS sampling in up to three MEC investigation grids where evidence of low-order detonations or ruptured rounds is discovered during the intrusive investigations in UXO 4 and UXO 6. This type of sampling is not deemed necessary UXO 3, UXO 7, or UXO 8 because the revised plan to conduct composite explosives sampling at those sites is deemed sufficient to verify whether explosives were associated with the practice bombs used at those sites.

RI sample results will be used to estimate the extent to which MEC or MPPEH items have resulted in contamination of media in their immediate vicinity so that the appropriate quantities of soil and sediment requiring remediation can be considered in the Feasibility Study. Analytical results will also be used to calculate EPCs for the risk assessments (see response to Comment 43). The need for additional sampling will be evaluated and discussed with the Partnering Team after the RI analytical results are known. Recommendations will be included in the RI Report.

45. **Comment: BACKGROUND: EPA understood the statistical comparison information would be presented with the first proposal to use the MCAS background data set. Please provide the statistical analysis and comparison. Modify the RIWP. (Also see specific comment on background below.)**

Response: Appendix A of Part 2 (MC SAP) has been revised to include additional text and tables demonstrating the statistical comparisons between the MCAS Beaufort and MCRD Parris background data sets.

46. **Comment: SOPs: The Draft SAP Part 2 does not provide laboratory standard operating procedures (SOPs). However, laboratory SOPs should be submitted for regulatory review and approval. The laboratory SOP information is needed so that it can be determined whether the samples will be prepared and analyzed in a sufficient manner in order to provide**

defensible results. For example, the Draft SAP Part 2 indicates that incremental samples will be dried, ground, and subsampled in accordance with SW-846 Method 8330B. To ensure the laboratory is performing in accordance with the referenced method, a review of the laboratory SOP is needed. Additionally, review of laboratory SOPs is necessary to evaluate the information in several of the SAP Worksheets (e.g., SAP Worksheet #19, Analytical SOP Requirements Table). Revise the Draft SAP Part 2 to provide all applicable laboratory SOPs for sample preparation and analysis.

Response: The laboratory SOPs have been added to Appendix E of Part 2 (MC SAP).

47. **Comment:** Please provide a copy of the Navy Chemist comments on these QAPP documents.

Response: Comments and responses resulting from review of Part 1 (MEC SAP) by the Navy MRP Technical Advisor and Part 2 (MC SAP) by the Navy Chemist have been added to the Appendix of the RIWP Introduction.

V. SPECIFIC COMMENTS – PART 2 MC

48. **Comment:** Draft SAP Part 2, SAP Amendments, Pages 23 of 158: Please modify the RIWP to indicate any amendments to the approved SAP require EPA and SCDHEC approval.

Response: Part 2 (MC SAP) Worksheet # 6 has been revised to state that any proposed amendments to the approved SAP will be submitted to the EPA and SCDHEC for review and approval.

49. **Comment:** SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Section 11.1, Problem Statements, Page 62 of 158: The first paragraph of Section 11.1 of SAP Worksheet #11 discusses soil, sediment, and groundwater. However, no explanation is provided for excluding surface water in the problem statement. According to SAP Worksheet #9, Project Scoping Session Participants Sheet, Page 33 of 158, due to the tidal nature of surface water at these sites, the collection of surface water samples would not be meaningful due to the continual mixing that occurs. Therefore, during the internal scoping meeting held on May 6, 2011, it was decided that surface water samples would not be collected at any sites. To promote clarity in SAP Worksheet #11, it is recommended that an explanation be provided that justifies exclusion of surface water samples from the Draft SAP Part 2. Furthermore, indicate whether NRTs approved of this approach following the internal meeting held on May 6, 2011.

Response: Part 2 (MC SAP) Section 11.1 has been revised to include justification for excluding surface water sampling from the scope. The NRTs have been provided an opportunity to review the RIWP and neither has commented on this element.

50. **Comment:** SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Section 11.1, Problem Statements, Page 64 of 158: In Section 11.1 of SAP Worksheet #11, site-specific problem statements are provided for UXO 2, UXO 4, and UXO 5. However, site-specific problem statements have not been prepared for UXO 3, UXO 6, UXO 7, and UXO 8 despite the fact that additional data will be collected at these sites to fill a data gap. It appears that problems statements can be made for these four other sites based on the information presented earlier in this section regarding the absence of historical data for some sites and to determine the extent of contamination identified during the SI. To promote clarity in the Draft SAP Part 2 for why additional sampling is required at UXO 3, -6, -7, and -8, and additional sampling other than the site-specific needs it is recommended that the discussion up front be formatted as a generic problem statement addressing all UXO sites in similar format as was done for UXOs 2, 4, and 5.

Response: Part 2 (MC SAP) Section 11.1 has been revised to include a subheading to clarify that the text prior to the site-specific problem statements presents the ***“Generic UXO 2 to 8 Problem Statement.”***

51. **Comment:** SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Section 11.2, Information Inputs, Page 65 of 158: In Section 11.2 of SAP Worksheet #11, the physical data proposed to be collected focuses on groundwater. However, according to the Executive Summary and SAP Worksheet #9, Project Scoping Session Participants Sheet, surface soil samples will also be analyzed for pH and sediment samples will be analyzed for pH and total organic carbon for use in the ecological risk assessment (ERA). To be complete, add the physical data that will be collected associated with surface soil and sediment sampling.

Response: Part 2 (MC SAP) Section 11.2 has been revised to include the physical parameters (pH and TOC) associated with sediment and surface soil samples.

52. **Comment:** SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Section 11.2, Information Inputs, Page 67 of 158: The text in Section 11.2 of SAP Worksheet #11, Page 67 of 158, indicates that the selected human health acceptable limit is an incremental lifetime cancer risk greater than 1×10^{-4} or a noncancer Hazard Index greater than 1 (based on common target organs or effects). This statement is not consistent with EPA guidance as EPA’s decision on whether a risk is acceptable is not necessarily the exceedance of the upperbound of the risk management range. Further, according to EPA guidance *“Role of the Baseline Risk Assessment in Superfund Remedy Decision Process, OSWER DIRECTIVE 9355.0-30 (EPA, 1991),* it is important to note that remedial action is generally not warranted if “the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}) and the non-carcinogenic hazard quotient is less than 1” unless there are adverse environmental impacts or if maximum contaminant levels (MCLs) or non-zero MCL goals are exceeded. To be consistent with EPA guidance (EPA, 1991), the statement regarding human health limits should be rephrased to address the cumulative nature of the risk and include the caveat regarding potential applicable or relevant and appropriate requirements that may apply to the site that may trigger the need for remediation regardless of the risk level.

Response: Part 2 (MC SAP) Section 11.2 has been revised to incorporate appropriate language from OSWER Directive 9355.0-30. The following clarification has been added, ***“Note that, according OSWER directive 9355.0-30 (USEPA, 1991), when the cumulative carcinogenic risk for both current and future land use is less than 1×10^{-4} and the non-cancer HI is less than 1 (based on common target organs), then action is not warranted unless there are adverse environmental impacts or if MCLs or non-zero MCLGs are exceeded.”***

53. **Comment:** SAP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Section 11.3.2, Sediment, Page 69 of 158: Section 11.3.2 of SAP Worksheet #11 states that the “shallowest depth of interest at each site is 0 to 6 inches below the sediment surface, as this is the sediment interval that relates to ecological exposure. At UXO 8, the depth of interest includes 6 to 24 inches below the sediment surface, as this interval relates to human health exposure (i.e., during shallow intrusive activities such as utility installation).” However, it is unclear if the shallowest depth of 0 to 6 inches below the sediment surface will also be collected at UXO 8 to address ecological risks. Clarify Section 11.3.2 to state if two intervals of sediment will be collected to ensure that ecological concerns are also addressed.

Response: To clarify that both sediment intervals will be sampled, Part 2 (MC SAP) Section 11.3.2 has been revised to replace “At UXO 8, the depth of interest includes...” with ***“At UXO 8, an additional depth of interest includes...”***

54. **Comment:** SAP Worksheet #15, Reference Limits and Evaluation Table, Page 88 of 158: A number of discrepancies were noted for the explosive constituents in SAP Worksheet #15 for the soils matrix by verification against Appendix A-3, Project Action Level Backup Tables, and the EPA Regional Screening Level (RSL) Table dated June 2011. According to the footnote on Page 88 of 158, the Residential Regional Screening Level (R-RSL) for noncarcinogens was adjusted downward by a factor of 10. However, it appears that this procedure, while appropriate, was not followed accurately. In addition, the Regional Soil Screening Level (R-SSL) was not always accurate for some constituents where the soil screening level in the EPA RSL table was multiplied by a dilution-attenuation factor of 20. Further, the lowest human health risk assessment (HHRA) PAL value was not always selected to ensure the reference limits could achieve these levels. The following discrepancies were noted between the latest version of EPA's RSL Table dated June 2011 and Attachment A-3:

Constituent	SAP Worksheet #15 HHRA PAL value (mg/kg)	Correct Lowest HHRA PAL value (mg/kg)	Note*
1,3,5 trinitrobenzene	22*	78 R-SSL	R-RSL 220
1,3-dinitrobenzene	0.061*	0.066 R-SSL	R-RSL 0.61
2,4-dinitrotoluene	0.0058	0.116 R-SSL	
2,6-dinitrotoluene	0.61*	1 R-SSL	R-RSL 6.1
Octahydro-1,3,5,7-tetranitro-1,3,5,7- tetrazocine (HMX)	38*	46 R-SSL	R-RSL 380
3-nitrotoluene	0.061*	0.068 R-SSL	R-RSL 0.61
2-nitrotoluene	0.078	0.0058 R-SSL	
Methyl-2,4,6-trinitrophenylNitramine (Tetryl)	2.4	24 R-RSL	
Nitrobenzene	0.16	0.0016	

mg/kg – milligrams per kilogram

Further, SAP Worksheet #15 does not indicate if the soils are reported as dry weight prior to comparing to the PALs. It is recommended that a thorough technical review be conducted on all constituents in the soil matrix tables included in SAP Worksheet #15 to ensure that the lowest HHRA and ERA PALs are correct. Additionally, a footnote should also be provided to explain if the soils are reported as dry weight.

Response: All of the soil and sediment values in Part 2 (MC SAP) Worksheet #15 were reviewed, and the discrepancies between Attachment A-3 and Worksheet #15 were corrected. In addition, a footnote was added to the soil and sediment tables to clarify that the results are reported in mg/kg, dry weight.

55. **Comment:** SAP Worksheet #15, Reference Limits and Evaluation Table, Page 95 of 158: A number of discrepancies were noted for the explosive constituents in SAP Worksheet #15 for the groundwater matrix, Page 95 of 158. The following discrepancies were noted:

Constituent	Worksheet #15 HHRA PAL value (µg/L)	Correct Lowest HHRA PAL value (µg/L)
1,3,5 trinitrobenzene	11	110 T-RSL
1,3-dinitrobenzene	0.037	0.37 T-RSL
2,4,6-trinitrotoluene	2.2	1.8 T-RSL
2,6-dinitrotoluene	0.37	3.7 T-RSL
Octahydro-1,3,5,7-tetranitro-1,3,5,7- tetrazocine (HMX)	18	180 T-RSL
3-nitrotoluene	0.037	0.37 T-RSL

Constituent	Worksheet #15 HHRA PAL value (µg/L)	Correct Lowest HHRA PAL value (µg/L)
4-Amino-2,6-Dinitrotoluene	0.73	7.3 T-RSL
2-Amino-4,6-Dinitrotoluene	0.73	7.3 T-RSL
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	1.5	15 T-RSL

µg/L – micrograms per liter

It is recommended that a technical review is conducted on all the tables for all matrices and all analytes included in SAP Worksheet #15 to ensure that the lowest HHRA PALs are correct.

Response: All of the groundwater values in Part 2 (MC SAP) Worksheet #15 have been reviewed, and the discrepancies between Attachment A-3 and Worksheet #15 have been corrected.

56. **Comment:** SAP Worksheet #28, QC Samples Table, Pages 135 of 158 and 136 of 158: SAP Worksheet #28, Pages 135 of 158 and 136 of 158, references the Department of Defense (DOD) Quality Systems Manual for Environmental Laboratories, Version 4.1 (QSM) for Quality Control (QC) limits. However, according to the *Uniform Federal Policy for Quality Assurance Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs* (Final Version 1), EPA-505-B-04-900A dated March (UFP-QAPP Manual), laboratory specific limits should be provided. It is recommended that the Draft SAP Part 2 provide laboratory limits to ensure the QSM values can be met.

Response: The Laboratory SOPs state that they will meet the DoD QSM criteria. DoD QSM Version 4.1 (October 2009) is a more current reference than the March 2005 UFP-QAPP Manual Guidance and is typically used for specifying QA/QC limits for DoD ELAP projects (i.e., rather than the laboratory statistically derived limits).

57. **Comment:** SAP Worksheet #28, QC Samples Table, Page 138 of 158: In SAP Worksheet #28, the table on Page 138 of 158 indicates that the Post Digestion Spike will be analyzed if the Serial Dilution fails. However, this sample should also be analyzed whenever the matrix spike (MS) sample does not meet acceptance criteria. It is recommended that SAP Worksheet #28 be corrected to indicate that the post digestion spike sample also be analyzed when the MS sample does not meet acceptance criteria.

Response: Part 2 (MC SAP) Worksheet #28 has been revised to include a Post Digestion Spike when the MS exceeds acceptance criteria.

58. **Comment:** Appendix A-3, Project Action Level Backup Tables: In Appendix A-3, according to the PALs listed in the table entitled Parris Island MC UXO Sites 3-8 Human Health Screening Criteria - Surface and Subsurface Soil Samples, the representative background levels were obtained from Appendix A-2, MCAS Beaufort Basewide Background. In the table, footnote 11 indicates the data was excerpted from the RCRA Facility Investigation Report for Solid Waste Management Unit 3, Borrow Pit Landfill; Appendix Z: Basewide Background Report, Marine Corps Air Station Beaufort, South Carolina (Tetra Tech, November 2006) and are represented by an 95% upper confidence limit (UCL) on the mean or maximum. Further, according to footnote 12 in the PAL table, the adjusted background level represents “Per USEPA Region 4 guidance, the adjusted site-specific background concentration is two times the representative concentration.” However, the background levels used are not according to EPA Region 4 guidance. EPA Region 4 guidance (EPA, 2000) specifically bases background on twice the arithmetic average concentration and not the 95% UCL or maximum. As a result, the background levels presented in Appendix A-2 and A-3 are overestimated and should not be used. The PALs should be revised to be consistent with EPA Region 4 guidance.

Reference cited:

USEPA, 2000. Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins, EPA Region 4, originally published November 1995, Website version last updated May 2000 (currently under revision):

<http://www.epa.gov/region4/waste/sf/programs/riskassess/healthbul.html>

Response: The Part 2 (MC SAP) Appendix A-3 tables have been revised to replace the Beaufort Background 95% UCL values with the arithmetic average values in the “Representative Concentration” column, and the values in the “Adjusted Representative Concentration” column have been revised to reflect 2 times the arithmetic average values.

NAVFAC LANT Chemist
UFP-SAP Review

Reviewer: Jon Tucker for Charles Cook
Document: Parris Island UXO 2-8 RI
Date: 21-Sep-11

Comment Number	Worksheet and/or Section	Rating (High or Low)	Statement or Issue	Comment	Response to Comment	Navy Response to Comment	Response to Comment
1	WS #3	L	Organization	Bonnie Capito is associated with NAVFAC Atlantic	The text has been revised accordingly.	Thank you	--
2	WS #11.2 #7	H	Data Reporting	On page 71 last paragraph before #8: Data is being reported to the DL with U flag for non-detects as preferred by SCDHEC. Why does the paragraph name J-flag data between LOD and LOQ rather than between DL and LOQ?	The text has been revised to reflect J-flagging of data between the DL and LOQ.	Thank you	--
3	WS #14.3	L	DoD ELAP sample prep	DoD ELAP doesn't accredit prep methods and 8330B appendix A isn't mentioned on their accreditation scope. It's not clear that they have accreditation for the prep method but it's not required either. I would remove mention of ALS' accreditation from WS #14 section 14.3.	Section 14.3 has been revised to not mention ALS' accreditation for Method 8330B sample preparation.	Thank you	--
4	General	H	COPCs	SAP CSM called for analysis of TNT and daughter products. Though TAL metals are being analyzed, suggest not analyzing for full suite of explosives group. Limit analytes to TNT and daughter products.	The CSM text mistakenly mentioned only the components of an MK1 75mm round. However, the M48 75mm round was also used. Components of the M48 75mm round included explosives other than TNT, such as tetryl and RDX (see MIDAS specifications in Appendix D). The text will be revised to include the M48 75mm explosive components, which is consistent with the analyte suite specified in the SAP.	Thank you, should 10.7.3.1 be updated in the same manner? Or were HE rounds not used at UXO 5 & 6?	Section 10.7.3.1 has been revised to reflect the possibility that HE rounds were also fired at the East Shrapnel Range (UXO 5 and 6).
5	WS #17.2	L	Number of samples	In second paragraph of Impact Area, it states that a minimum of 6 samples will be collected but then states there are 7 default sampling locations, please clarify.	There are actually only six default locations, as shown on Figure 17-2. The text has been corrected.	Thank you	--
6	WS #17.3	H	IS Triplicate	Is the triplicate for QA purposes or statistical purposes? If QA, then an RSD needs to be established and included on WS #12. If statistical, there is no need to include anything on #12. I believe it is for statistical purposes.	The field triplicate is used for QA purposes in a similar manner to the field duplicate. An RSD criterion has been added to Worksheet #12 for the triplicate.	RSD has not been added to WS #12.	An RSD of 30% for the field triplicate was presented in the original Worksheet 12. Thus, this criterion was not "added," but rather was "confirmed" on Worksheet 12. The RSD originally included on Worksheet 28 has been revised to reflect the same 30% criterion.

Note:

High Rating - Requires comment to be addressed prior to Government Chemist signature.

Low Rating - RPM may use their discretion. The change is advised but not required for the SAP to

APPENDIX B-2

**RESPONSES TO CONDITIONAL APPROVAL LETTERS FOR
REMEDIAL INVESTIGATION WORK PLAN
MUNITIONS RESPONSE PROGRAM
UNEXPLODED ORDNANCE SITES 2, 3, 4, 5, 6, 7, 8
MCRD PARRIS ISLAND (TETRA TECH, JANUARY 2012)**

**RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 4 (EPA)
CONDITIONS FOR APPROVAL OF
REMEDIAL INVESTIGATION WORK PLAN (RIWP)
MUNITIONS RESPONSE PROGRAM (MRP)
UNEXPLODED ORDNANCE (UXO) SITES 2, 3, 4, 5, 6, 7, AND 8
MARINE CORPS RECRUIT DEPOT (MCRD) PARRIS ISLAND**

Comments transmitted by Lila Llamas, March 16, 2012

RESPONSES TO EPA CLARIFICATIONS FOR THE ADMINISTRATIVE RECORD:

1. **Comment:** UXO1 is not being investigated under this Remedial Investigation Work Plan (RIWP). Rather, a Site Inspection (SI) is being planned for under an Expanded SI Work Plan (ESIWP), which may or may not produce data which will suffice as an RI investigation. All comments pertaining to UXO1 will be made in response to the submittal of that document on the corresponding review schedule.

Response: Comment noted.

2. **Comment:** Although mentioned in the RIWP, further investigation of UXO2 is being planned for under an ESIWP, which may or may not produce data which will suffice as an RI investigation. All comments pertaining to UXO2 will be made in response to the submittal of that document on the corresponding review schedule.

Response: Comment noted.

3. **Comment:** A new subarea in UXO4 was recently discovered. Therefore the investigation of this area, the UXO4 Rocket Range subarea, is being planned for under an ESIWP which may or may not produce data which will suffice as an RI investigation. All comments pertaining to this portion of UXO4 will be made in response to the submittal of that document on the corresponding review schedule. Until this area has been fully investigated and produced RI level data, the RI for UXO4 cannot be considered complete.

Response: Comment noted.

4. **Comment:** During scoping meetings for addressing the SI and RI phases of the CERCLA process at UXO Sites 1 through 8, the theoretical maximum penetration depths for munitions fired on the sites and the instrument capabilities limitations (depth to which subsurface surveys are effective) for the geophysical survey equipment being used were discussed. The penetration depth exceeded the effective survey depth in most cases at most sites, resulting in a vertical data gap. The RIWP calls for intrusive investigation which may fill some of the gap in areas where it is applied.

Response: The RIWP contains a detailed discussion regarding the theoretical and expected penetration depths of munitions fired at each site (see Part 2 [MEC SAP] Sections 10.4.3.1, 10.5.3.1, 10.6.3.1, 10.7.3.1, and 10.8.3.1) as compared to the detection capabilities of geophysical instruments to be used in the RI (see Part 2 [MEC SAP] Section 17.9.1). Based on this information, it is possible that at the conclusion of the RI some vertical data gaps may remain at UXOs 4 and 6, where the 75-mm projectiles could have penetrated deeper than the detection capabilities of the survey instruments. Additional vertical data gaps may exist at UXO 7 and, possibly, UXO 3 in areas where non-native material (e.g., fill or pavement) was placed on top of the original ground surface, masking the ability of the survey instruments to detect items originally deposited within the top two feet of ground surface. The extent of vertical data gaps at each site will be better understood following the RI data collection effort.

Comment: Similarly, data gaps exist between survey transects which are spaced at distances greater than the effective width of the survey equipment. Survey transect spacing has reportedly been designed to ensure that distinct regions of concentrated munitions presence can be defined, but not to identify all anomalies within the site boundaries.

Response: Consistent with general EPA methodology for conducting RIs, this investigation is designed to collect representative and biased sampling data from selected locations (i.e., the sample set), which can be used to support decision-making for the entire corresponding decision unit (i.e., the population). The sampling approach presented in the RIWP combines the step-wise collection of field data from focused areas (e.g., transects and grids) with statistical evaluation methods that allow for the extrapolation of results to similar areas, as appropriate. The planned transect surveys will facilitate delineation of probable impact areas; and the planned grid surveys and analytical sampling will provide characterization data for regions representing worst-case conditions within those impact areas. The areas between transects are not considered to be data gaps but, rather, they constitute non-investigated areas within the overall study boundaries. Through proper planning and design, conclusions regarding nature and extent can still be drawn with a high degree of certainty by extrapolating data from the “sample set” to the entire “population” even if the area within the study boundaries is not investigated at 100 percent. The identification of all anomalies at all locations within the expansive site boundaries that define most of the MCRD Parris Island MRP sites is not an objective of this investigation, although it will likely be an element of one or more remedial alternatives evaluated during the Feasibility Study (FS).

Comment: Additional surveys and intrusive actions may be planned for in the remediation phase if sites are found to require remediation. However, this information will not be available at the time remedial decisions are being made. Therefore these gaps have to be accounted for and considered during remedial decision making. Site specific concerns are highlighted as follows:

- **Comment:** UXO3 as depicted in RIWP figures is covered by the parade ground. A small grassy area adjacent to the target area is being investigated, to ensure no

munitions or range related debris is present. However, investigation of the target site itself is not being conducted.

Response: It is anticipated that the data collected during the RI will provide physical evidence that can be used to better define the boundaries of contamination, if any, at UXO 3. If evidence of historical site use is uncovered during intrusive investigations near the borders of the grassy area, the Navy will consider collecting subsurface geophysical data in the adjacent paved area(s), pursuant to discussions with the Partnering Team. However, given the current use of this site for weekly recruit ceremonies, no intrusive investigation of anomalies will be conducted beneath the pavement at this time. The existing pavement provides an effective barrier that prevents contact with any munitions-related items that may be buried underneath and mitigates any associated exposure hazards.

- **Comment:** UXO4 is being investigated, however vast areas of marsh within the impact zone are inaccessible, and therefore only the limited area of navigable waterways is being investigated. Both the land and the waterways will likely have vertical data gaps. Survey transects are spaced far apart, and therefore data gaps may exist between transects. This may be sufficient for locating dense areas of anomalies in the RI, but not for clearing the area of concern in all areas investigated within the site boundaries. Additionally, the lower boundary of the impact zone does not encompass the full extent of the distance munitions may have traveled. Finally, UXO4 Rocket Range subarea is being investigated separately, pending plan review and approval.

Response: The RI design incorporates the use of statistical methods through the application of VSP techniques to evaluate data collected from the indicated survey/sampling areas. The design also includes the collection of data in step-out areas, as necessary, to better define the boundaries of contaminated regions at each site. Horizontal and vertical data gaps that remain at the completion of the RI will be identified in the RI Report; however, it is expected that sufficient data will be collected under the current approach to support the development and evaluation of remedial alternatives for the FS.

- **Comment:** The exact location of UXO5 is unknown.

Response: The SI included an investigation of the UXO 5 firing point location, as interpreted from the historical site drawing presented in the ASR. No physical evidence confirming the actual firing point location (e.g., through detector-aided survey results, analytical data, or the presence of physical features) was discovered during the SI. Thus, the RI is designed to expand the area of data collection to ensure that the lack of physical evidence was not a result of incorrect placement of the firing point location.

- **Comment:** UXO6 is being investigated, however vast areas of marsh within the impact zone are inaccessible, and therefore only the limited area of navigable

waterways is being investigated. UXO6 encompasses very little dry land. Both the land and the waterways will likely have vertical data gaps. Survey transects are spaced far apart, and therefore data gaps may exist between transects. This may be sufficient for locating dense areas of anomalies in the RI, but not for clearing the area of concern in all areas investigated within the site boundaries. Additionally, the lower boundary of the impact zone does not encompass the full extent of the distance munitions may have traveled.

Response: Comment noted. Horizontal and vertical data gaps that remain at the completion of the RI will be identified in the RI Report.

- **Comment:** UXO7 is located in a developed golf course. Much disturbance of the soils reportedly occurred during construction. Various depths of fill material were placed on the site. Therefore vertical data gaps are likely. Data gaps may exist between survey transects, but to a much lesser extent at this site as planned.

Response: Comment noted. The extent of vertical data gaps will be quantified based on depth of fill observed during sample collection. Horizontal and vertical data gaps that remain at the completion of the RI will be identified in the RI Report; however, it is expected that sufficient data will be collected under the current approach to support the development and evaluation of remedial alternatives for the FS.

- **Comment:** UXO 8 is located in a tidal flat area. The entire site is being investigated; however, SI data indicates the actual location of the target area may not be where originally anticipated. Also, tidal action may have moved munitions around. Therefore, the exact extent of the site boundary is unknown. Additionally, vertical and horizontal data gaps may exist.

Response: Field observations made during the SI indicated physical evidence of the actual target location approximately 400 feet northwest of the originally presumed location. Both locations are being investigated under the RI, as are large adjacent areas where surface debris has been observed. In addition, step-out investigations will be conducted, as necessary, to define the boundaries of site contamination. It is not anticipated that any vertical data gaps will remain upon completion of the RI, as the detection instrumentation capabilities are sufficient to detect buried munitions items at their respective theoretical maximum penetration depths in sand. Horizontal data gaps that remain at the completion of the RI will be identified in the RI Report; however, it is expected that sufficient data will be collected under the current approach to support the development and evaluation of remedial alternatives for the FS.

Comment: Based on these site conditions, the investigation plans submitted, limitations of instruments, inaccessibility of site areas, etc. remedial decisions being made will apply to the areas being investigated, to the extent they are investigated. The Navy may present evidence or arguments which may clear some areas of concern. However, it is likely at a

minimum these sites will need Land Use Controls (LUCs), and the remedy decisions may be considered interim until technology is available to clear the sites, or both.

Response: Comment noted.

5. **Comment:** The Munitions and Explosives of Concern (MEC) investigation, Part 1, is intended to delineate the nature and extent of munitions as a source of contaminants and potential safety hazards. The investigation is designed according to a system which uses basic background information about a site and the munitions used on site, along with information about the capabilities and limitations of technical equipment, to ensure that distinct regions of concentrated munitions presence can be defined, but not to identify all anomalies within the site boundaries. However, the investigation is not being applied to all portions of the site; therefore EPA is hesitant to accept that the design will ensure all distinct regions of concentrated munitions presence can be defined. Furthermore, there has been no evidence provided to indicate these were not historically used as ranges (with the exception of UXO1) or that a range clearance has been performed. Consequently, EPA will keep this in mind when considering any areas for exclusion from further consideration as part of the MRA based on not finding any physical evidence of munitions use. Alternatively, EPA may call for additional surveys and/or intrusive investigations to be conducted before further consideration.

Response: Comment noted.

6. **Comment:** The Munitions Constituents (MC) investigation, Part 2, calls for very limited sampling based on worst case scenario biased samples. However, the plan is being designed without knowing how many distinct regions of concentrated munitions will be detected, and on sites where the targets were most likely relocated frequently. While it may seem obvious that taking a soil sample directly below a buried MEC would be a worst case, there may be areas with extremely dense shrapnel on the surface which may actually have been a greater source for MC leaching than a buried item large enough to be detected with survey equipment. Therefore EPA is hesitant to accept the very limited biased sampling as being sufficient to delineate nature and extent of contamination and to represent an entire exposure unit without having a better sense of the density and distribution of munition sources. Consequently, EPA repeats previous concerns that the number of samples planned will likely be insufficient and additional samples and/or implementation of a VSP/Triad based approach may be required.

Response: The overall approach to investigating the MRP sites incorporates a dynamic data collection strategy that is consistent with the Triad approach) whereby field geophysical data is used to direct the subsequent collection of additional field geophysical data (in grids and step-out areas) and analytical data (throughout each site, judgmentally biased toward locations expected to represent worst-case conditions, and systematic where no biased conditions exist). The investigative approach outlined in the RIWP relies heavily on the application of Visual Sample Plan (VSP) methodology and statistical analysis to focus the investigation efforts on strategically selected areas that will provide the most useful information. Also, in addition to the planned sample

locations that are shown in the Part 2 (MC SAP) figures, the RIWP provides for the collection of discretionary samples if/where physical evidence of MEC or MPPEH (including shrapnel) is discovered in surface and subsurface soil within investigation grids and at firing points, surface sediment in swales, and submerged sediment in waterways. If all biased, systematic, and discretionary samples described in the work plan are collected, approximately 300 metals analyses and 180 explosives analyses will be performed under this RI. The need for additional sampling and analysis will be assessed following completion of the planned data collection effort based on review of the field data and analytical results and subsequent conclusions reached by the Partnering Team.

RESPONSES TO EPA COMMENTS WHICH WERE NOT ACCEPTED AS FINAL:

(Note: These do not require change pages to the RIWP or other action at this time.)

7. **Comment:** The following RTCs will be reviewed and considered during review of the ESIWP for UXOs 1, 2, and 4 Rocket Range Subarea: 2a, 2b, 7, 8 (regarding these UXOs), all of 11, 16, 39, 40f, 40g.

Response: Comment noted.

8. **Comment:** Comment #18 – While “NAVSEA” (undefined in the response) may not consider fencing, wire, signs, posts, nails, etc. to be “range-related debris” as defined, CERCLA requires remediation of site contaminants which present potential unacceptable risks. If the material is present in waste form and in significant amounts it may be considered a source for site contaminants, and as such EPA may require the material be included and remediated. This decision can be made after a determination that a remedial action is necessary.

Response: During the RI fieldwork, if range-related materials such as fencing, wire, sign posts, or nails are observed, and the items are determined to be present in the form of discarded waste, the potential impacts to surrounding media will be investigated.

9. **Comment:** Comments #22a, b, and c – These areas may require investigation pending review of the results of this RIWP.

Response: Comment noted.

10. **Comment:** Comments 41h and i – Based on the information in the response, the groundwater well locations should not be moved. However, additional wells will most likely be required in the areas of highest density of MEC/MPPEH once the MEC portion of the investigation is complete.

Response: It is assumed that this comment refers to Comments #42h and i. The groundwater well installation will be conducted at the end of the planned fieldwork, following the completion of the MEC investigation. A two-day coordination period is

incorporated into the schedule to allow for Partnering Team concurrence on the final selection of well locations. The possible need for installing additional wells based on information obtained during the MEC investigation will be discussed at that time.

11. **Comment:** Comment 41j – EPA’s understanding is that MEC/MPPEH has already been detected at UXO4, therefore sediment samples just off the land areas will not be considered optional. However, EPA recommends the Navy get concurrence on the location of the samples based on the highest density MEC/MPPEH areas found near the marsh, rather than simply locating the samples “near surficial MEC/MPPEH”.

Response: It is assumed that this comment refers to Comment #42j. The sediment samples to be collected from swales leading to site surface water are not considered to be optional. Rather, these samples will be collected from discretionary (biased) locations that are downgradient from surficial MEC/MPPEH finds. As provided for in Worksheet #6, the proposed locations of these and other biased samples will be submitted to the Partnering Team for review and concurrence prior to sample collection. MEC/MPPEH density distributions will be considered in the selection of appropriate biased sampling locations.

12. **Comment:** Comment 43 and 44 – EPA was not present at the internal project scoping meeting where these decisions were made. EPA has concerns that some of the UXOs are represented by too few samples to generate a sample set truly representative of the entire UXO site. Additionally, EPA is not convinced the samples will be taken based on worse case scenarios. Such limited sampling and biased locations may not be considered sufficient to represent delineation of nature and extent on large sites. Additionally, on such large sites, typically SI results would indicate suspect areas and often the site is divided into smaller decision units within the exposure unit. EPA retains the right to call for this type of site management in the case of the larger sites being addressed in this RIWP. EPA will address these concerns once the result of the MEC investigation is complete. Therefore, additional samples may be required. Additionally, due to the age of the site and the extensive degradation and transport that may have occurred over time, as well as the potential for target areas to have been located anywhere, EPA may require these additional samples be implemented in accordance with VSP/Triad or incremental sampling for contaminants other than explosives.

Response: Sample quantities were selected in coordination with the Tetra Tech risk assessors who will be evaluating the RI data and conducting the human health and ecological risk assessments. Sufficient quantities were designated for each medium at each site to ensure that the data sets used to calculate exposure point concentrations would satisfy statistical requirements. While the UXO sites may cover large areas, the associated conceptual site models (CSMs) incorporate a fairly simple model of contaminant deposition that anticipates the highest levels of chemical contamination to be either collocated with MEC/MPPEH or dispersed in the general vicinity of firing point locations. The analytical data planned for collection under this RI, combined with data collected previously under the SI, are designed to characterize both representative and worst-case contaminant concentrations at firing points and in target/impact areas for the

munitions known to be used at the respective UXO sites. The ability to further divide each UXO site (i.e., Munitions Response Area) into decision units smaller than these two types of areas (i.e., individual Munitions Response Sites) is one of the objectives of the RI, as described in the Part 1 (MEC SAP) Worksheet #11 decision rules. The combined use of field and analytical data collection methodologies and the application of VSP techniques, as outlined in the work plan, will enable a more complete site characterization than would be possible through the collection of analytical data alone. (See also Response to Comment #6 above.)

13. **Comment:** Several responses to EPA General Comments on the Draft SAP Part 2 state that the need for additional sampling will be evaluated and discussed with the Partnering Team after the remedial investigation (RI) analytical results are known. Consequently comments 42b, 42i, 43, and 44 on the Draft SAP Part 2 will be revisited once the RI data have been validated and summarized in support of further discussions for whether a second phase of samples are required.

Response: Comment noted.

14. **Comment:** Several responses to EPA General Comments on the Draft SAP Part 2 state that the need for additional sampling will be evaluated and discussed with the Partnering Team after the remedial investigation (RI) analytical results are known. Consequently it is recommended that General Comments 42b, 42i, 43, and 44 on the Draft SAP Part 2 also be revisited once the RI data have been validated and summarized in support of further discussions for whether a second phase of samples are required.

Response: Comment noted.

RESPONSES TO EPA CONDITIONS FOR APPROVAL WHICH REQUIRE ACTION:

15. **Comment:** General Comment #6 – For UXO 1, it is still unclear with which UXO site the Rifle Grenade Courts are associated. The information provided pertaining to the Munitions Response Program (MRP) Archive Search Report (ASR) and/or the Preliminary Assessment (PA) discusses the grenade courts within the site information for Khe Sahn/Range A. However, the Figure INT-3 indicates Range A with a yellow rectangle and the grenade courts with red dots. Red, as used elsewhere on the same figure, indicates the boundaries for current UXO sites being investigated. The text allows for the possibility that UXO1's location has been misinterpreted. Please clarify for the administrative record to which range these grenade courts belong and properly color code/label them accordingly on Figure INT-3 (e.g. if with UXO1, keep them red and add UXO1a; if Range A, color them yellow or green and add a subarea indicator A# as used in the ASR/PA (check for the accurate number to use). **Submit the revised Figure as a condition of approval.**

Response: The Hand Grenade Courts and the Rifle Grenade Circles shown on ASR Plate 3 (as Subareas A1 and A3, respectively) are not part of any UXO site currently being investigated under the MRP because both sites are associated with an active range.

These sites are considered to be subareas of the Khe Sahn/Range A and, as such, will be addressed under a separate investigation after that range is closed. Figure INT-3 has been revised to add the Hand Grenade Court (approximately 500 feet west of the Rifle Grenade Circles) and to indicate both grenade sites in green (rather than red), signifying that they are “other ranges not in the MRP.” **A change page containing the revised Figure INT-3 has been provided.**

16. **Comment:** Figure INT-3 – In addition to the condition above, please modify the following: Add a colored dot for firing point R. Indicate the UXO4 Rocket Range Subarea. Clarify the red oblong on top of Inchon/Range E. If this is not part of the current UXO boundaries, please either delete it or change the color and/or move it and properly label it. The blue rectangle to the southeast of Range A is confusing. It appears to create a non-training area inside the training area. Perhaps it was intended to encapsulate the various ranges along that coast. If this was the purpose, perhaps a white line such as that used in the arrows would be less confusing. Please modify or delete the rectangle for clarification. Properly identify the various ranges near Range A as being subareas of A in accordance with the ASR/PA and properly label them as such. **Submit the revised figure as a condition of approval.**

Response: Figure INT-3 has been revised to: reinsert the icon for Firing Point R, include the UXO 4 Rocket Range subarea outline, replace the red oval on top of Inchon/Range E with a properly labeled green oval, and replace the blue rectangle with a green rectangle labeled “Small Bore Ranges.” **A change page containing the revised Figure INT-3 has been provided.**

17. **Comment:** General Comment #8 – Since Natural Resource Trustees (NRTs) indicated comments had been incorporated into EPA’s comments and/or that they will not be commenting at this time (which might imply they will comment later), EPA needs a record of NRTs’ position with respect to satisfaction with the RIWP D2 before considering the document approved. Satisfactory acceptance of UXOs 1, 2, and 4 Rocket Range Subarea may be provided while proceeding through review of the ESIWP. **Provide a record of the NRTs’ satisfactory acceptance of the RIWP D2 for at least UXO’s 3 through 8 as a condition of approval.**

Response: The NRTs’ e-mailed responses to requests for review of the RIWP have been added to the RIWP Introduction Appendix A. **The corresponding change pages have been provided.**

18. **Comment:** Comment #s 12, 13, 36, and 40 e-g – Comment 12 pertained to a “Sitewide” Eco Risk Assessment (ERA) meaning across all UXO sites as might be encountered within the natural home range area of the species, and therefore did not only apply to UXO2, but also to possibly include UXOs 4, 5, 6, 7, and 8 according to where the home range might apply. The Navy/MCRD’s response addressed only contaminant levels at UXO2. EPA’s comment allowed for the inclusion of non-site range areas, proportioning of the home range, averaging across a range, etc. as appropriate in an ERA. EPA

recognizes the Navy/MCRD's point regarding insectivorous versus carnivorous species, and once the analytical results are in, this indeed may ultimately be determined to be an indicator species for an ERA. However, to be responsive to NRT concerns, to be inclusive, and to document consideration of a wide range of species as potential receptors, including the endangered species known to have inhabited certain areas on MCRD and including a variety of species with various home range sizes, the lists of possible receptors for each UXO in corresponding subsections of Worksheet 10 entitled "Land Use, Receptors, and Exposure Pathways" should be updated to include the Endangered and Special Status Species identified in Section 10.2.8. **Please submit the updated change pages for these subsections as a condition for approval.**

Response: The previous responses to these comments were interpreted as applying to the UXO 2 ERA because that is the only site where a preliminary ERA had been requested for inclusion in the RIWP. However, to be responsive to the intent of these comments, the requested changes have been made to Part 2 (MC SAP) Worksheet #10 and **the corresponding change pages have been provided.**

Comment: Furthermore, the Navy/MCRD arguments for or against approaches as a valid means of evaluating ecological risk in an Eco Risk Assessment (ERA) and/or the inclusion or exclusion of certain species should be made in the Baseline Risk Assessment portion of the work plan. Consequently, it has come to EPA's attention this portion of the RIWP appears to be missing from the RIWP. EPA recognizes that since very little analytical data of any significance is currently available it is difficult to know how to plan for a site-specific BRA at this point, or even at which UXOs one will be necessary. Therefore, in lieu of including the plans for a BRA in this RIWP, EPA will accept presentation of the plan during a scoping session for the RI Report. This should occur after analytical results are available and a determination has been made that the analytical data is sufficient to delineate nature and extent of contamination, but BEFORE the RI Report is drafted and submitted. The Navy/MCRD should plan for this scoping session in their schedule such that this can be accomplished in a meaningful and effective manner while still meeting enforceable deadlines for the RI Report. **Please submit a schedule for scoping and development of the BRA as a condition for approval. Ensure the NRTs are invited to participate and given sufficient notice of the date, time, and place.**

Response: A general description of the risk assessments to be performed as part of the RI is already included in Part 2 (MC SAP) Worksheet #11. To ensure that the Partnering Team is in agreement regarding the details of the approach to be used in the RI, the validated RI data and results of the risk screening process (i.e., comparisons of data to PALs) will be presented to the Partnering Team and NRTs during an RI scoping session prior to conducting the risk assessments. This scoping session has been added to the project schedules in Worksheet #16 of both Part 1 (MEC SAP) and Part 2 (MC SAP), and **the corresponding change pages have been provided.**

19. **Comment:** Comments #20c and #21d – EPA will attempt to meet requests of expedited review (e.g. 1 or 2 days) of the proposed grid locations. However, the Navy/MCRD

should provide notice ahead of time as to approximately when to expect them so that EPA can put the MEC expert on alert and expedited review can be planned for. While the response indicates an expedited review will be “requested”, Worksheet 6 indicates a fixed review time of 1 to 2 business days. Modify Worksheet 6 to indicate an expedited review time of 1 to 2 business days will be requested, as stated in the response to comments. **Submit the revised Worksheet #6 affected page as a condition for approval.**

Response: Worksheet #6 of both Part (MEC SAP) and Part 2 (MC SAP) have been modified to reflect that the Partnering Team will be requested to provide review within 2 business days, and **the corresponding change pages have been provided.** Additional time may be provided if the field schedule allows, but the Partnering Team is asked to respect the requested review periods whenever possible to avoid crew standby time if other work activities cannot be scheduled for those periods. To assist with planning efforts, the Navy will coordinate with the Partnering Team approximately 3 days prior to the dates when transmittal of data is expected to occur.

20. **Comment:** Comment 27 – EPA General Comment 27 is correctly addressed with the exception of the Unexploded Ordnance (UXO) Team Separation distance for unintentional detonations during manual operations. Table 17-1 lists the distance as K40⁽²⁾ of the munition with the greatest fragmentation distance (MGFD). Superscript (2) indicates that K40 of the MGFD is used because these items are non-fragmenting and do not have an associated hazardous fragment distance (HFD) or maximum fragment distance (MFD). While this statement is generally correct for some of the sites listed, it is not appropriate for UXO Sites 4, 5, or 6. This is due to the fragmenting nature of the 75-millimeter projectiles fired there. DoDM 6055.09-M-V7, February 29, 2008 (Department of Defense Ammunition and Explosives Safety Standards, Volume 7, Criteria for Unexploded Ordnance, Munitions Response, Waste Military Munitions, and Material Potentially Presenting an Explosive Hazard, states the following:

“V7.E3.7.2.2. Team Separation Distance (TSD). The greatest distance of:
V7.E3.7.2.2.1. Blast overpressure, as computed by the formula: $D = 40W^{1/3}$
[$D=15.87Q^{1/3}$].
V7.E3.7.2.2.2. The appropriate downwind hazard distance for CAs” (chemical agents).

Revise Table 17-1 of RIWP Part 1 to eliminate superscript (2) from the basis column for the UXO Teams in the Manual Site Operations row of UXO Sites 4, 5, and 6. **Submit the revised Table as a condition for approval.**

Response: Part 1 (MEC SAP) Table 17-1 has been revised to remove superscript (2) from the “UXO 4, 5, and 6” K40 entry and to reflect other corrected entries in accordance with Tables 6-2.1 through 6-2.8 of the DDESB-approved Explosives Safety Submission (ESS). **The change page containing Table 17-1 has been provided. In addition, the approved ESS and the DDESB approval letter have been included in the change pages for Part 1 (MEC SAP) Appendix A.**

21. **Comment:** DECISION RULES – Decision rules need to be modified as follows:

- a. **Comment:** Decision Rule #1 states this only applies to UXO # 5. However, Incremental sampling is also proposed for any incomplete detonation MEC at other UXOs. Clarify if this should also apply if IS samples are taken in UXOs other than UXO5. **If so, a change page is necessary for clarification.**

Response: Decision Rule #1 has been revised to indicate its applicability not only to UXO 5 but also to grid locations at other UXO sites where evidence of incomplete detonation is discovered and incremental sampling is performed. **The corresponding change page has been provided.**

- b. **Comment:** Decision Rule # 2 should indicate the partnering team should be convened to determine if MC contamination has been adequately delineated and if the data is sufficient for completing the RI. If not, then a decision needs to be made if additional data is needed before proceeding to Decision Rule #3.

Response: Decision Rule #2 has been modified accordingly, and **the corresponding change page has been provided.**

- c. **Comment:** Decision Rule #4 – The bullets for each media should be modified to allow for the risk management decisions being made between 10^{-4} and 10^{-6} , rather than recommending no further investigation.

Response: Decision Rule #4 has been modified accordingly, and **the corresponding change page has been provided.**

Comment: Submit change pages accordingly as a condition for approval.

Response: The Part 2 (MC SAP) Worksheet #11 change pages have been provided.

22. **Comment:** General Comment 42b – EPA General Comment 42b requested that at least one groundwater sample should be included at UXO Sites 4 and 5 for the analysis of propellants and other munitions constituents (MC) at firing points. The Navy has included groundwater sampling to address this comment for UXO Site 4. However, there is no explanation why groundwater is not required at Firing Point T at UXO Site 5. The RIWP Part 2 was reviewed and confirmed that groundwater samples are not planned for UXO Site 5. **Provide an explanation why groundwater samples are not planned for UXO Site 5. Otherwise, a sample should be proposed at Firing Point T or explain if groundwater samples are contingent on the results of soil sampling.**

Response: The Navy assumes that this comment relates to General Comment 42g, which indicated that the Navy could wait for soil sample results to make an argument against the need for groundwater samples. No groundwater sampling is planned for UXO 5 because the low-level exceedances of the ecological PAL for lead reported during the SI did not indicate a threat to groundwater at this site. As indicated in the response to

Comment 42g, “The need for additional groundwater sampling will be evaluated and discussed with the Partnering Team after the RI analytical results are known.” **No change pages are necessary.**

23. **Comment:** Comment 52 – Please ensure that screening levels based on risks of 10^{-6} are used for screening site data. This may require changes to listed screening levels or PALs. **If changes are necessary, submit revised change pages accordingly.**

Response: As stated in the Appendix F Screening Criteria table footnotes, PALs are based on published EPA risk-based screening levels that represent an incremental lifetime cancer risk of 1×10^{-6} . **No change pages are necessary.**

24. **Comment:** Comment 55 – Specific Comment 55 has been partially addressed and incorporated into the RIWP Part 2. However, additional clarification is warranted. Appendix F, Project Action Limit Backup Tables, was reviewed to evaluate the revisions to the project action levels in response to the comment. Upon review of the table entitled “Parris Island MC UXO Sites 3-8 Human Health Screening Criteria – Groundwater Samples” in Appendix F, two issues were identified as follows:

- i. **Comment:** All entries for the column entitled “EPA Regional Screening Level, Vapor” are “NA.” Since a footnote is not provided, presumably the NA corresponds to “not applicable” which would apply to the metals since metals are not volatile as well as most of the nonvolatile explosives. However, nitrobenzene and 2-nitrotoluene are considered volatile according to EPA’s Vapor Intrusion Guidance (EPA, 2002). Consequently, it is unclear why all entries in this column are “NA.” Clarify why EPA Regional Screening Levels (RSLs) for groundwater that are protective of indoor air exposures to nitrobenzene and 2-nitrotoluene have not been calculated following EPA Vapor Intrusion Guidance (EPA, 2002). **This may or may not require a change page.**

Response: A change page is provided for the Part 2 (MC SAP) Appendix F Project Action Limit Backup Table based on EPA’s current Vapor Intrusion Screening Level (VISL) Calculator (USEPA, March 2012). The Calculator lists the VISL for nitrobenzene as 62 micrograms per liter ($\mu\text{g/L}$) but lists no value for 2-nitrotoluene (identified in the table as o-nitrotoluene, with a “—” value). The nitrobenzene tapwater RSL ($0.12 \mu\text{g/L}$) is lower than the VISL; thus, the PAL for nitrobenzene is unchanged by the addition of a VISL.

- ii. **Comment:** The column entitled “Minimum Criteria” presumably lists the lower of the adjusted EPA RSL or the EPA maximum contaminant level (MCL). However, it appears that an MCL is listed as the minimum criterion even if the MCL exceeds the purely health-based adjusted RSL. This raises a concern that the site groundwater contamination relies on MCLs for delineation rather than purely health-based values as represented by the adjusted RSL. **Correct this table to select the lower of the adjusted RSL or MCL to ensure delineation is based on health-based values and submit the change page.**

Response: Change pages are provided for Part 2 (MC SAP) Worksheet #15 and the Appendix F Project Action Limit Backup Table to identify the lower of the adjusted EPA RSL or the EPA MCL as the appropriate PAL for groundwater.

25. **Comment:** Comment 58 – The response to EPA Specific Comment 58 states that the Appendix A-3 tables have been revised to replace the Beaufort Background 95% upper ninety fifth confidence limit on the mean values with the arithmetic average values in the “Representative Concentration” column and the values in the “Adjusted Representative Concentration” column have been revised to reflect two times the arithmetic average values. Appendix A-3 could not be located in the RIWP Part 2. However, it appears that the edit discussed in the response to EPA Specific Comment 58 has been appropriately reflected in Appendix F, Project Action Limit Backup Tables. **Ensure that the RIWP Part 2 references Appendix F when discussing the background screening values for soil and sediment to promote clarity in the document and submit change pages.**

Response: The tables that were formerly presented in Appendix A-3 of the D1 SAP were moved to Appendix F in the D2 SAP. The response to Comment 58 is the only citation in the D2 transmittal that refers to these tables as being in Appendix A-3. Thus, **no change pages are necessary.**

**RESPONSES TO SOUTH CAROLINA DEPARTMENT OF HEALTH AND
ENVIRONMENTAL CONTROL (SCDHEC) CONDITIONS FOR APPROVAL OF
REMEDIAL INVESTIGATION WORK PLAN (RIWP)
MUNITIONS RESPONSE PROGRAM (MRP)
UNEXPLODED ORDNANCE (UXO) SITES 2, 3, 4, 5, 6, 7, AND 8
MARINE CORPS RECRUIT DEPOT (MCRD) PARRIS ISLAND**

Comments transmitted by Meredith Amick, SCDHEC, March 16, 2012

1. **Comment:** Please note the Department reiterates the following statement, “Land Use Controls are required by SCDHEC as a portion of a remedy on all munitions sites. Therefore, no actual munitions site can be given an NFA. As discussed in team meetings, the Department can concur with no further investigation needed but the remedy will have to include Land Use Controls. At a minimum these Land Use Controls should include a process that, with future use (i.e. construction, property transfer, etc), will provide notification that the area was previously used as a range. This notification will also help with proper management of any waste discovered.” This will apply to all areas considered to be part of munitions sites (MRAs); however, more detailed LUCs may be applicable to MRSs determined to contain munitions.

Response: Comment noted. **No changes to the Remedial Investigation Work Plan (RIWP) are required.**

2. **Comment:** The Final ESS should be submitted as part of the D2 Expanded SI Work Plan to evaluate the potential need for any RCRA emergency permits for detonation of recovered MEC.

Response: The Explosives Safety Submission (ESS) approved by the Department of Defense Explosives Safety Board (DDESB) is included in Part 1 (MEC SAP) Appendix A of the Remedial Investigation Work Plan (RIWP). The ESS has also been appended to the Expanded Site Inspection (ESI) Work Plan (WP), as well. **Change pages have been provided to present the DDESB-approved ESS and associated approval letters in both the RIWP and the ESI WP.**

3. **Comment:** This is the Department’s first review of the Proposed Background Values to be used at several sites at Parris Island (UXOs 2-8, Site 14, etc), which was submitted as part of the Response to comments on the previous version of the SAPs. The following comments are applicable to the Soil and Sediment Background Data Evaluation. The Department recommends responding to these comments as part of the Expanded SI D2, because the documents are interrelated and so the administrative process can move forward.
 - a. Please provide a map of where the MCRD samples were taken. It is believed that these samples are the ones taken for the Site 3 background, which the Department has already stated are not applicable to other sites at Parris Island.

- b. Because of the limited data set from MCRD, the Department does not believe it is appropriate for use as a comparison to MCAS background.
- c. The following statement is made, “Since the two background metals concentration data sets were statistically similar for most of the soil and sediment data, then combining the two separate background soil and sediment data sets into a larger, more robust data set for use in the background soil and sediment concentration calculations at both MCRD Parris Island and MCAS Beaufort is warranted for those target analytes which were determined to be statistically similar.” This seems to indicate that MCAS Beaufort should also begin using the combined data set. However, the MCAS background has been approved for use by the Department at MCAS and will not be modified.
- d. The Department expected to see a comparison of soil types between MCAS Beaufort and MCRD Parris Island. If soil types are similar then the Department believes that the MCAS Beaufort soil and sediment background data set can be used at MCRD Parris Island as it is being used at MCAS Beaufort. The MCAS data set should not be manipulated.

Response: As discussed at the April 2012 Partnering Team meeting, the Background Data Evaluation has been revised to eliminate the Site 3 background data and the statistical comparisons of the Site 3 data set to the approved MCAS Beaufort background data set. The revised Background Evaluation, which is included in Part 2 (MC SAP) Appendix A, focuses only on comparisons of soil types at Marine Corps Air Station (MCAS) Beaufort to those at MCRD Parris Island. The evaluation concludes that soil types at the two installations are similar and, thus, the soil and sediment background data sets previously established and approved for use at MCAS Beaufort is also applicable to MCRD Parris Island. **Change pages have been provided to present the revised Background Evaluation in both the RIWP and ESI WP.**

- 4. **Comment:** The Department Reiterates Comment #4 from the November 17, 2011 Comments to the RI WP D1, “Firing Points not on active ranges should be within MRP Site boundaries. Please make appropriate changes to maps. (i.e. Firing Point C, D, F, and R for UXO 4, Firing Point T for UXO 5, etc.) This is important as they will require at least the minimum Land Use Controls (See Comment #1). This should be addressed on all figures presented in subsequent reports.

Response: Firing points were included as part of the MRP sites during the SI and are included as part of the MRP sites for the RI, as demonstrated by their presence in the RIWP on figures and in the investigation strategies for the artillery ranges. Uprange firing fans for the concrete firing positions (Firing Points B, H, and R), where high explosive (HE) munitions were fired, are within the currently defined UXO site boundaries. Uprange firing fans for the non-concrete firing positions (Firing Points A, C, D, E, F, L, and T), where shrapnel munitions were fired, will be incorporated within

revised UXO site boundaries, as necessary, based on field observations and data to be collected during the RI. **No changes to the RIWP figures have been made, but future changes to site boundaries will be presented, as necessary, in the RI Report.**

5. **Comment:** In subsequent reports, active ranges should be carved out of UXO Site (MRA) boundaries because during remedy selection LUCs cannot be applied to active ranges.

Response: The active ranges at MCRD Parris Island are already carved out of UXO Site boundaries, as indicated in the work plan figures and in the text of Part 1 (MEC SAP) Section 10.6.1 and Part 2 (MC SAP) Section 10.7.1. To clarify, text has been added to the end of Part 1 (Introduction) Section 1.0 to state: “Areas associated with active ranges (as indicated by orange highlighting on Figure INT-2, INT-3 and other figures throughout the RIWP) are not subject to the MRP and, thus, not considered part of the UXO investigation areas. These ranges will be investigated at a later date following the permanent termination of firing activities and the subsequent re-classification of these ranges as other than operational.” Also, the following sentence will be added to the second paragraphs of Part 1 (MEC SAP) Section 10.5.1 and Part 2 (MC SAP) Section 10.6.1: “Areas associated with the active ranges at the Weapons and Field Training Battalion are not included as part of the MRP site because they are still in operation.” **RIWP change pages have been provided to document these revisions.**

6. **Comment:** Sediment Characterization Report: Please use Best Management Practices on active ranges (as recommended by the Department per the REVA review Amick to Harrington November 25, 2008). Please note the Sediment Characterization Report has been forwarded to SCDHEC Region 8 for further review.

Response: Comment noted. This comment does not impact the planned investigation; thus, **no changes to the RIWP are necessary.**

7. **Comment:** The Department does not fully agree with the revised text in Section 11.2. SCDHEC would like to emphasize that the selection of chemicals of concern, cleanup goals, and remedy selection is a site specific decision and should not be automatically set to a cancer risk level greater than or equal to 1×10^{-4} . Per USEPA RAGs, the point of departure for ILCR risk is 1×10^{-6} or an HI below 1, with a risk management decision being necessary by the risk managers when the ILCR is within the 1×10^{-6} to 1×10^{-4} range. Please note, this risk management range must be maintained.

Response: The text in Part 2 (MC SAP) Section 11.2 regarding the use of 1×10^{-4} as a risk management benchmark was summarized from language presented in OSWER Directive 9355.0-30. To clarify, the first full paragraph at the top of page 75 of 169 has been modified to state: “Note that according to OSWER Directive 9355.0-30 (EPA, 1991), when the cumulative carcinogenic risk for both current and future land use is less than 1×10^{-4} (based on reasonable maximum exposure) and the non-cancer HI is less than 1 (based on common target organs), then action is generally not warranted unless there

are adverse environmental impacts or if MCLs or non-zero goals are exceeded.” Also, the fourth bullet of Decision Rule #4 in Section 11.4, which calls for the application of risk management decisions by the Partnering Team on a case-by-case basis when the incremental lifetime cancer risk (ILCR) is within the 1×10^{-4} to 1×10^{-6} target range has been incorporated appropriately within each of the first three bullets (i.e., Soil, Sediment, and Groundwater) rather than being a stand-alone summary bullet. **RIWP change pages have been provided to document these revisions.**

8. **Comment:** A Preliminary Ecological Risk Assessment is provided for UXO2. Once new data is obtained as part of the Expanded SI Work Plan, the risk evaluation should be updated in the Expanded SI Report.

Response: Results of both the health risk screening and ecological risk screening of data to be collected under the Expanded SI will be presented in the Expanded SI Report. If screening results indicate that a more thorough risk evaluation is necessary, this will be included in the RI Report, as outlined in Part 2 (MC SAP). **No changes to the RIWP are necessary.**

**RESPONSES TO SOUTH CAROLINA DEPARTMENT OF HEALTH AND
ENVIRONMENTAL CONTROL (SCDHEC) CONDITIONS FOR APPROVAL OF
REMEDIAL INVESTIGATION WORK PLAN (RIWP) FOR
UNEXPLODED ORDNANCE (UXO) SITES 3 THROUGH 8
MARINE CORPS RECRUIT DEPOT (MCRD) PARRIS ISLAND**

Comments transmitted by Annie Gerry, SCDHEC, March 9 2012

1. **Comment:** **Part 2-MC SAP, Page 40-UXO 3-** The text reads, *Samples (soil and groundwater) will be analyzed for metals only. (Specification sheets for the practice bombs used at UXO 3, UXO 7, and UXO 8 do not list any nitroaromatic compounds, so explosives will not be analyzed at those sites).* For UXO 7, the text reads, “*Samples (soil and groundwater) will be analyzed for metals only*”

Even though this was a prior decision agreed upon by the Partnering Team and since then has changed, as per the text (See Pages 108, 110, 111, 114, and Response to EPA’s Comment #42 G), where it specifies that soil and groundwater will be sampled for both metal and explosives, it should be understood that soil and groundwater must be analyzed for metals and explosives even though the worksheets (e.g. Worksheet #18, Worksheet #20) provided in this document do not reflect that.

Response: The omissions on Worksheets #18 and 20 have been corrected to reflect explosives analyses for the groundwater samples at UXOs 3 and 7. (Note that explosives analyses for soil samples at UXOs 3, 7, and 8 are already correctly reflected, and there are no groundwater samples planned for UXO 8.) **RIWP change pages have been provided to document these modifications.**

Becker, Barb

From: Becker, Barb
Sent: Wednesday, January 04, 2012 3:58 PM
To: 'Priscilla Wendt'
Cc: Llamas, Lila (llamas.lila@epa.gov); 'charles.cook2@navy.mil'; 'timothy.j.harrington@usmc.mil'; 'mmcrae@TechLawInc.com'; 'AmickMS@dhec.sc.gov'; 'GerryAM@dhec.sc.gov'; 'KRIEGKM@dhec.sc.gov'; 'lisa.donohoe@usmc.mil'; Smith, Preston; Churchill, Peggy
Subject: RE: Parris Island MRP Sampling and Analysis Plan

Priscilla,

Thanks so much for your response. We'll note this in the project file.

Barb

Barb Becker, PMP | Senior Project Manager
Direct: 610.382.3770 | Main: 610.491.9688 | Mobile: 949.929.2748 | Fax: 610.491.9645
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From: Priscilla Wendt [<mailto:WendtP@dnr.sc.gov>]
Sent: Wednesday, January 04, 2012 3:54 PM
To: Becker, Barb
Cc: Llamas, Lila (llamas.lila@epa.gov); 'charles.cook2@navy.mil'; 'timothy.j.harrington@usmc.mil'; 'mmcrae@TechLawInc.com'; 'AmickMS@dhec.sc.gov'; 'GerryAM@dhec.sc.gov'; 'KRIEGKM@dhec.sc.gov'; 'lisa.donohoe@usmc.mil'; Smith, Preston; Churchill, Peggy
Subject: RE: Parris Island MRP Sampling and Analysis Plan

Barb,

Sorry about the delay. Yes, you are correct. I reviewed the screening level Ecological Risk Assessment (ERA) for UXO Site 2, as well as portions of the MRP SAP that are relevant to evaluating ecological risk at the other UXO sites, and spoke with Lila Llamas at length about the ERA for UXO Site 2. Her comment letter accurately captures our discussion and mutual concerns. I concur with her comments and have no additional comments on the SAP.

Regards,
Priscilla Wendt

Priscilla Wendt
SC Department of Natural Resources
Office of Environmental Programs/ MRD
P.O. Box 12559

Charleston, SC 29422

Phone: 843-953-9305

Fax: 843-953-9399

E-mail: wendtp@dnr.sc.gov

From: Becker, Barb [<mailto:Barb.Becker@tetrattech.com>]

Sent: Wednesday, December 21, 2011 5:31 PM

To: Priscilla Wendt

Subject: Parris Island MRP Sampling and Analysis Plan

Priscilla,

In follow up to our conversation last week, I just wanted to check to see if you were planning to send an email documenting your review of the Sampling and Analysis Plan for the Munitions Response Program Remedial Investigation at Unexploded Ordnance Sites 2, 3, 4, 5, 6, 7, and 8 at Marine Corps Recruit Depot –Parris Island. You mentioned on the phone that your review comments were already incorporated in the comments we received from Lila Llamas at USEPA Region 4, but I was hoping you could confirm that for our records by sending a short email, as well.

Feel free to contact me by phone or email if you have any questions or concerns.

Regards,
Barb Becker

Barb Becker, PMP | Senior Project Manager

Direct: 610.382.3770 | Main: 610.491.9688 | Mobile: 949.929.2748 | Fax: 610.491.9645

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Becker, Barb

From: Cook, Charles CIV NAVFAC SE <charles.cook2@navy.mil>
Sent: Thursday, January 19, 2012 6:00 PM
To: Becker, Barb; Churchill, Peggy
Subject: FW: Parris Island MRP Sampling and Analysis Plan
Signed By: charles.cook2@navy.mil

For our records,

-----Original Message-----

From: michel.gielazyn [<mailto:michel.gielazyn@noaa.gov>]
Sent: Thursday, January 19, 2012 16:58
To: Cook, Charles CIV NAVFAC SE
Subject: Re: Parris Island MRP Sampling and Analysis Plan

Charles,

Unfortunately, I will not be able to review the subject document.

Please keep me on the mailing list for future activities.

Thank you,

Michel

On 1/6/2012 5:23 PM, Cook, Charles CIV NAVFAC SE wrote:

> Michel, Jan 20, our document is dew final to EPA January 30 2012, if you could provide your review by January 20 this will allow us time to incorporate comments as needed.

> Thanks for your help

> Charles Cook 904 542 6409

>

> -----Original Message-----

> From: michel.gielazyn [<mailto:michel.gielazyn@noaa.gov>]

> Sent: Friday, January 06, 2012 17:13

> To: Cook, Charles CIV NAVFAC SE

> Cc: Priscilla Wendt; Llamas.Lila@epamail.epa.gov; Troy Baker

> Subject: Re: Parris Island MRP Sampling and Analysis Plan

>

> Charles,

> Due to my other obligations, I have not had an opportunity to review

> this document. Please remind me of the due date and I will see if I can

> fit it in over the next few weeks.

> Thank you,

> Michel

>

Michel L. Gielazyn, Ph.D.

Regional Resource Coordinator

NOAA - Assessment& Restoration Division

263 13th Avenue South

St. Petersburg, FL 33701

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cell: 727-269-6314

michel.gielazyn@noaa.gov

APPENDIX C

TRAINING RANGES AT MCRD PARRIS ISLAND

MCRD PARRIS ISLAND RANGE SUMMARY TABLE

(Information extracted from Archives Search Report [USACE, 1999a] and
Range Identification and Preliminary Range Assessment Report [USACE, 1999b])

Range Name	Range Status	Range Location on Figure INT-3
Khe Sanh/Range A	Active	Weapons and Field Training Battalion Area
Hue City/Range B	Active	Weapons and Field Training Battalion Area
Chosin/Range C	Active	Weapons and Field Training Battalion Area
Starlight/Range D	Active	Weapons and Field Training Battalion Area
Inchon/Range E	Active	Weapons and Field Training Battalion Area
Pusan Range	Active	Weapons and Field Training Battalion Area
Nak Tong Range	Active	Weapons and Field Training Battalion Area
Recreational Firing Range (now known as Suribachi Range)	Active	Weapons and Field Training Battalion Area
Rocket and Mortar Impact Area	In-Active, In Service Other Range	Weapons and Field Training Battalion Area
Indoor Small Bore Range (Building 765)	Active, currently Air Rifle	Weapons and Field Training Battalion Area
Miscellaneous Training Stations, Courses and Maneuver Areas	Active	Any areas of MCRD Parris Island that are not fully developed are suspect for this type of training
Guadalcanal Hand Grenade Range	Active	Between UXO 5 and UXO 6
Mine and Booby Trap and Practice Grenade and Mine Field Range	Active	Page Field Training Area - south of east-west runway
Practice Grenade Range	Active	Page Field Training Area - north of east-west runway
Combat Assault Course	Active	Page Field Training Area - center of former Page Field
Gas Chamber (Bldg. 793)	Active	Page Field Training Area - within former cantonment area
Aerial Bomb Target at Page Field	In-Active, In Service	Page Field Training Area - eastern edge of Page Field

MCRD PARRIS ISLAND RANGE SUMMARY TABLE

**(Information extracted from Archives Search Report [USACE, 1999a] and
Range Identification and Preliminary Range Assessment Report [USACE, 1999b])**

Range Name	Range Status	Range Location on Figure INT-3
Strafing Range at Page Field	In-Active, In Service	Page Field Training Area - exact location could not be ascertained but thought to have been on the southeast end of the airfield
Aerial Bombing Target at Golf Course	Discontinued	UXO 7
Trap and Skeet Ranges at Page Field	Discontinued	North of Page Field Training Area - north of cantonment area
Recreational Firing Range at Horse Island	Active	Horse Island
Aerial Bombing Target at Parade Deck	Discontinued	UXO 3
Rifle Range at Ballast Creek	Discontinued	UXO 2
Field Artillery West Main Range	Discontinued	UXO 4
Field Artillery East Shrapnel Range	Discontinued	UXO 5/6
Gas Chamber (Bldg. 685)	Discontinued, In Service	Main Cantonment Maneuver Area – west side of cantonment area
Aerial Bombing Target at Southern Tidal Flats	Discontinued	UXO 8
Gas Chamber at Elliott's Beach	Discontinued, Building Razed	Elliott's Beach Training Area – along Broad River shoreline
Grenade Range Near Old Swimming Pool at Weapons and Field Battalion Area	Discontinued, of Questionable Existence	UXO 1
Fuse Range at Elliott's Beach	Discontinued, of Questionable Existence (believed to be confused with one of the practice grenade ranges at Page Field)	Elliott's Beach Training Area – near the Tactical Bivouac Area, inland from Elliott's Beach
Hand Grenade Range near Elliott's Beach	Discontinued, of Questionable Existence (believed to be confused with Guadalcanal Hand Grenade Range)	Elliott's Beach Training Area – near the boat launch at Elliott's Beach

APPENDIX D

PRELIMINARY ECOLOGICAL RISK EVALUATION FOR UXO 2

1.0 ECOLOGICAL RISK SCREENING

The goal of the Ecological Risk Screening (ERS) for UXO 2 was to evaluate the potential for adverse ecological impacts of site-related contamination and to determine the need for further investigation and/or remedial action at the site. The ERS contains information to enable scientists and managers to conclude either that ecological risks at the Site are most likely negligible or that further information is necessary to evaluate potential ecological risks at the Site.

1.1 PROBLEM FORMULATION

1.1.1 Potential Exposure Pathways

Terrestrial ecological receptors such as plants, soil invertebrates, mammals, and birds can be exposed to contaminated surface soil through direct contact as they search for food and burrow into the soil. Sediment invertebrates can be exposed to chemicals in sediment. Mammals and birds can also ingest contaminated surface soil, sediment, surface water, and food items in which contaminants have accumulated. For this project, data from sediment from 0 to 0.5 feet and 2 to 3 feet were evaluated together.

1.1.2 Assessment and Measurement Endpoints

Assessment endpoints are explicit expressions of the environmental value that is to be protected (U.S. EPA, 1997). The selection of these endpoints is based on the habitats present, the migration pathways of chemicals, and the routes that chemicals may take to enter receptors. Measurement endpoints are estimates of biological impacts (e.g., mortality, growth, reproduction) that are used to evaluate the assessment endpoints. The assessment endpoints and measurement endpoints used to evaluate UXO 2 data are presented in Table 1-1. The potential receptors at the site include soil invertebrates, terrestrial plants, insectivorous mammals and birds, sediment invertebrates, insectivorous mammals and birds, and piscivorous mammals and birds.

For vertebrate receptors, selection of a particular species is required so that intake through eating can be estimated. The following surrogate species were used for the food chain modeling that was conducted to evaluate risks to mammals and birds:

- Insectivorous mammal: Short-tailed shrew
- Insectivorous bird: American robin
- Piscivorous mammal: Mink

- Piscivorous bird: Green heron

USEPA guidance (USEPA, 1997) states that “it is not practical or possible to directly evaluate risks to all of the individual components of the ecosystem at a site. Instead, assessment endpoints focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals from the site.” Therefore, this ERS focuses on the endpoints tending to yield the highest risks, which should account for endpoints that have lower risks.

Large carnivorous birds and mammals were not selected as assessment endpoints because their home range (hundreds of acres) is much larger than the site (approximately 17 acres), so they would only consume a small portion of food from this area. Therefore, risks would be greater to small mammals and birds that obtain all or most of their food from the site. Although some limited reptiles (i.e., snakes) may be present at the site, they were not selected as assessment endpoints because of the general lack of toxicity information and the lack of methods to evaluate their exposure to chemicals.

1.2 ECOLOGICAL EFFECTS EVALUATION

An Ecological Effects Quotient (EEQ) approach was used to characterize the risk to ecological receptors. This approach characterizes potential effects by comparing exposure concentrations with effects data. An EEQ of greater than 1.0 was considered to indicate potential risk. Such values do not necessarily indicate that an effect will occur but only that a low (i.e., conservative) threshold has been exceeded.

The EEQs for surface soil receptors were calculated as follows:

$$EEQ = \frac{C_{ss}}{SSSL}$$

where:

EEQ	=	Ecological Effects Quotient (unitless)
C _{ss}	=	Contaminant concentration in surface soil (ug/kg or mg/kg)
SSSL	=	Surface soil screening level (ug/kg or mg/kg)

The EEQs for aquatic receptors were calculated as follows:

$$EEQ = \frac{C_{sd}}{SdSL}$$

where:

EEQ	=	Ecological Effects Quotient (unitless)
Csd	=	Contaminant concentration in sediment (mg/kg)
SdSL	=	Sediment screening level (mg/kg)

The following generic equation was used to calculate the exposure point concentrations (EPCs) as chronic daily intake (CDI) for mammals and birds from exposure to chemicals in soil/sediment and associated food items such as soil/sediment invertebrates:

$$CDI = \frac{[(C_f * I_f) + (C_s * I_s) + (C_w * I_w)] * H}{BW}$$

Where:

CDI	=	Chronic daily intake [milligrams per kilogram (mg/kg)-day]
Cf	=	Chemical concentration in food – (see discussion below)
Cs	=	Chemical concentration in surface soil or sediment (mg/kg)
If	=	Food ingestion rate [kilograms per day (kg/day)]
Is	=	Incidental surface soil or sediment ingestion rate (kg/day)
H	=	Portion of food intake from the contaminated area (unitless)
BW	=	Body weight (kg)

The exposure assumptions (i.e., ingestion rate, body weight) were obtained primarily from the Wildlife Exposure Factors Handbook (U.S. EPA, 1993) with other sources used as necessary. Food ingestion rates were presented on a dry weight basis and chemical concentrations in the food items were estimated in dry weight concentrations. This was done to be consistent with chemical concentrations in soil and sediment, which are reported on a dry weight basis. The exposure assumptions are presented in Table 1-2.

The EEQ for the terrestrial wildlife model was calculated as follows:

$$EEQ = \frac{CDI}{TRV}$$

where:

EEQ	=	Ecological effects quotient (unitless)
CDI	=	Chronic daily intake dose (mg/kg-day)
TRV	=	Toxicity reference value [no observable adverse effect level (NOAEL) or lowest observable adverse effect level (LOAEL)] (mg/kg-day)

1.2.1 Surface Soil

Five surface soil samples were collected and analyzed for lead. Table 1-3 provides a summary of the results compared to screening criteria for surface soil receptors. Concentrations of lead in two of the samples (15.4 mg/kg and 15.5 mg/kg in samples X02SS02G0001 and X02SS05G0001, respectively) slightly exceeded the USEPA Eco SSL for lead for avian receptors (11 mg/kg). Lead concentrations were well below USEPA Eco SSLs for plants (120 mg/kg) and soil invertebrates (1,700 mg/kg). Because the surface soil screening level for lead was exceeded for a wildlife receptor, a food chain model was completed for insectivorous birds and mammals. Table 1-4 provides the results of the food chain model. The EEQ for lead was less than 1.0 based on the NOAEL in the food chain model using conservative exposure assumptions indicating that risks to insectivorous birds and mammals are not likely.

1.2.2 Sediment

Twenty sediment samples from ten locations were collected and analyzed for lead. Samples were collected in the southeastern portion of UXO 2. Table 1-5 provides a summary of the results compared to screening criteria for sediment. Concentrations of lead in six of the samples, with a maximum concentration of 142 mg/kg, exceeded the USEPA Region 4 screening value for lead of 30.2 mg/kg. This screening level is the threshold effects level (TEL) from MacDonald et al. (1994), which is the upper limit of the range of sediment contaminant concentrations that are dominated by no effects data. The probable effects level (PEL), the higher effects level for the TEL, is the lower limit of the range of sediment contaminant concentrations that are usually or always associated with adverse biological effects. The PEL for lead is 112 mg/kg. These values are based on protection of aquatic organisms, including benthic macroinvertebrates, fish, and shellfish. One sample, 112 mg/kg in sample X02SD07G0006, equals the PEL and one sample, 142 mg/kg in sample X02SD09G0006, exceeds the PEL. Therefore, there is a potential for impact from lead to sediment invertebrates; however, the area of any potential impact would be very small.

Because the sediment screening level for lead was exceeded, a food chain model was completed for piscivorous birds and mammals. Tables 1-6 to 1-7 provide the results of the food chain models. For the conservative exposure scenario, the maximum concentration of lead was used. The value used for soil was 15.5 mg/kg, and the value used for sediment was 142 mg/kg. For the average exposure scenario,

the average lead concentration for all samples was used to provide a more realistic exposure scenario as is typical in ecological risk assessments. The value used for soil was 12.2 mg/kg, and the value used for sediment was 74.1 mg/kg. Lead has EEQs greater than 1.0 based on the NOAEL in the food chain model using conservative exposure assumptions for the mink and green heron. Using less conservative exposure assumptions (i.e., an average exposure scenario), the EEQ for lead is less than 1.0 based on the NOAEL, indicating that risks to piscivorous birds and mammals are not likely.

1.3 SUMMARY AND CONCLUSIONS

Based on the information collected during the MRP SI at UXO 2, no unacceptable risks exist for surface soil ecological receptors from lead and a small potential risk exists for aquatic ecological receptors from lead in sediment. The sampling was biased to collect samples in areas suspected/known to be target areas. The samples collected are sufficient to determine whether ecological risks are present at the site. Although the eastern most sediment sample location X02SD07 equaled the PEL for sediment, the concentrations outside of that area would not be expected to be greater than the sample concentrations collected near the concrete target foundations. Additionally, the lead found in sediment is typically less bioavailable to ecological receptors in areas where high concentrations of total organic carbon and organic matter are present because metals will bind with the organic carbon. The representative TOC at UXO 2 in sediment is 8,800 mg/kg or 8.8%. Standard toxicity values are often based on a TOC of 1%. Therefore, additional sampling for lead in sediment and surface soil is not deemed necessary to complete the ecological risk assessment for UXO 2.

TABLE 1-1

**ASSESSMENT ENDPOINTS AND MEASUREMENT ENDPOINTS
ECOLOGICAL RISK SCREENING
UXO 2 - RIFLE RANGE AT BALLAST CREEK
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA**

Assessment Endpoint	Measurement Endpoint
Adverse effects on the survival, reproduction, and/or growth of soil invertebrates	<ul style="list-style-type: none"> Survival, growth, and/or reproduction of soil invertebrates will be evaluated by comparing the measured concentrations of chemicals in the surface soil to invertebrate soil screening levels.
Adverse effects on the survival, reproduction, and/or growth of sediment invertebrates	<ul style="list-style-type: none"> Survival, growth, and/or reproduction of sediment invertebrates will be evaluated by comparing the measured concentrations of chemicals in the sediment to sediment screening levels.
Adverse effects on the survival, reproduction, and/or growth of aquatic organisms	<ul style="list-style-type: none"> Survival, growth, and/or reproduction of aquatic organisms will be evaluated by comparing the measured concentrations of chemicals in the surface water to surface water screening levels.
Adverse effects on the survival, reproduction, and/or growth of terrestrial plants	<ul style="list-style-type: none"> Survival, growth, and/or reproduction of terrestrial plants will be evaluated by comparing the measured concentrations of chemicals in the surface soil to plant soil screening levels.
Adverse effects on the survival, reproduction, and/or increase in development effects of insectivorous birds	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of birds will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and earthworms to No Observed Adverse Effects Levels (NOAELs) and Lowest Observed Adverse Effects Levels (LOAELs) for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of insectivorous mammals	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of mammals will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and earthworms to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of wetland invertivore birds	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of mammals will be evaluated by comparing the estimated ingested dose of contaminants in the sediment and aquatic organisms to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of wetland invertivore mammals	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of birds will be evaluated by comparing the estimated ingested dose of contaminants in the sediment and aquatic organisms to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of piscivorous mammals	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of mammals will be evaluated by comparing the estimated ingested dose of contaminants in the sediment and aquatic organisms to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of piscivorous birds	<ul style="list-style-type: none"> Survival, reproduction, and/or increase in development effects of birds will be evaluated by comparing the estimated ingested dose of contaminants in the sediment and aquatic organisms to NOAELs and LOAELs for surrogate wildlife species.

TABLE 1-2

EXPOSURE PARAMETERS FOR THE TERRESTRIAL WILDLIFE MODEL
UXO 2 - RIFLE RANGE AT BALLAST CREEK
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

Species/Exposure Inputs	Conservative Inputs		Average Inputs	
	Values	Units	Values	Units
American Robin				
Body Weight = BW	7.73E-02	kg	8.04E-02	kg
Food Ingestion Rate = If	1.25E-02	kg/day	1.19E-02	kg/day
Water Ingestion Rate = lw	1.21E-02	L/day	1.13E-02	L/day
Soil Ingestion Rate - Is	2.046E-03	kg/day	7.601E-04	kg/day
Home Range = HR	Assume 100% on site		6.095E-01	acres
Short-Tailed Shrew				
Body Weight = BW	1.500E-02	kg	1.610E-02	kg
Food Ingestion Rate = If	1.600E-03	kg/day	1.433E-03	kg/day
Water Ingestion Rate = lw	4.280E-03	L/day	3.600E-03	L/day
Soil Ingestion Rate - Is	4.801E-05	kg/day	1.289E-05	kg/day
Home Range = HR	Assume 100% on site		9.699E-01	acres
Mink				
Body Weight = BW	5.500E-01	kg	1.103E+00	kg
Food Ingestion Rate = If	6.067E-02	kg/day	4.504E-02	kg/day
Water Ingestion Rate = lw	1.213E-01	L/day	7.308E-02	L/day
Sediment Ingestion Rate = Is	5.703E-03	kg/day	4.234E-03	kg/day
Home Range = HR	Assume 100% on site		1.558E+03	acres
Green Heron				
Body Weight = BW	2.00E-01	kg	2.12E-01	kg
Food Ingestion Rate = If	3.10E-02	kg/day	3.00E-02	kg/day
Water Ingestion Rate = lw	2.20E-02	L/day	2.10E-02	L/day
Sediment Ingestion Rate = Is	1.600E-03	kg/day	1.500E-03	kg/day
Home Range = HR	Assume 100% on site		1.000E+01	km-radius

Notes:

The soil/sediment ingestion rates were calculated by multiplying the food ingestion rates by the following incidental soil/sediment ingestion rates:

	Conservative	Average	Source
American Robin	16.40%	6.40%	1,2
Short-tailed Shrew	3%	0.90%	1
Mink	9.40%	9.40%	3,4
Green Heron	5%	5.00%	5

1 - USEPA (U.S. Environmental Protection Agency), 2007. Attachment 4-1. Ecological Soil Screening Level Guidance, Office of Emergency and Remedial Response. February.

2 - Based on the American woodcock

3 - Beyer, N., E. Connor, and S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife. Journal of Wildlife Management 58(2) pp. 375-382.

4 - Based on the raccoon

5- Based on piscivorous birds

TABLE 1-3
OCCURENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
UXO 2 - RIFLE RANGE AT BALLAST CREEK
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Minimum Result	Maximum Result	Location of Maximum Detection	Sample of Maximum Detection	Minimum Nondetection	Maximum Nondetection	Average of Positive Results ⁽¹⁾	Overall Average ⁽²⁾	Screening Level				COPC (yes/no)?	Rationale for COPC Selection	Further Evaluated in Terrestrial Food Chain Modeling (yes/no)? ⁽³⁾
										Plants	Invertebrates	Avian	Mammals			
Inorganics (mg/kg)																
LEAD	5/5	7.2	15.5	X02SB05	X02SS05G0001	---	---	12.18	12.18	120	1700	11	56	YES	ASL	YES
Miscellaneous Parameters (s.u.)																
pH	1/1	7.7	7.7	X02SB05	X02SS05G0001	---	---	7.7	7.7	NA	NA	NA	NA	NA	NA	NA
Miscellaneous Parameters (%)																
TOTAL SOLIDS	5/5	70	82	X02SB04	X02SS04G0001	---	---	74	74	NA	NA	NA	NA	NA	NA	NA

Note: Shading indicates exceedance of the screening level (minimum criteria).
NA = Not Applicable

Source of Screening Level
USEPA Ecological Soil Screening Levels (SSL) (USEPA, 2005)

- 1 - Average of detected concentrations only.
2 - Average of all analytical results including one-half of the detection limit for non-detects.
3 - Chemicals with concentrations exceeding screening levels for birds or mammals are retained for food chain modeling.

TABLE 1-4

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
INSECTIVOROUS RECEPTORS
UXO 2
MRCR PARRIS ISLAND, PARRIS ISLAND, SOUTH CAROLINA

Chemical	Insectivorous Receptors EEQs			
	Robin		Short-Tailed Shrew	
	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics				
LEAD	9.8E-01	3.6E-02	1.8E-01	4.5E-03

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE 1-5

OCCURENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEDIMENT
UXO 2 - RIFLE RANGE AT BALLAST CREEK
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

Parameter	Frequency of Detection	Minimum Result	Maximum Result	Location of Maximum Detection	Sample of Maximum Detection	Minimum Nondetection	Maximum Nondetection	Average of Positive Results	Overall Average	Region 4 Screening Level	COPC (yes/no)?	Rationale for COPC Selection	Further Evaluated in Terrestrial Food Chain Modeling (yes/no)?
Inorganics (mg/kg)													
LEAD	20/20	3.5	142	X02SD09	X02SD09G0006	---	---	25.725	25.725	30.2	YES	ASL	YES
Miscellaneous Parameters (mg/kg)													
TOTAL ORGANIC CARBON	1/1	8800	8800	X02SD10	X02SD10G0006	---	---	8800	8800	NA	NA	NA	NA
Miscellaneous Parameters (%)													
TOTAL SOLIDS	20/20	65	81	X02SD09; X02SD10	X02SD09G2436; X02SD10G2436	---	---	74.075	74.075	NA	NA	NA	NA

Note: Shading indicates exceedance of the screening level.
NA = Not Applicable

Source of Screening Level
Region 4 Screening Level (USEPA, 2001)

□

TABLE 1-6

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
PISCIVOROUS RECEPTORS
UXO 2
MRCR PARRIS ISLAND, PARRIS ISLAND, SOUTH CAROLINA

Chemical	Piscivorous Receptors EEQs			
	Mink		Green Heron	
	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics				
LEAD	2.3E+00	5.9E-02	8.9E+00	3.2E-01

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient

TABLE 1-7

TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
PISCIVOROUS RECEPTORS
UXO 2
MRCR PARRIS ISLAND, PARRIS ISLAND, SOUTH CAROLINA

Chemical	Piscivorous EEQs			
	Mink		Green Heron	
	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics				
LEAD	1.1E-01	2.7E-03	7.8E-01	2.8E-02

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level

LOAEL - Lowest Observed Adverse Effects Level

EEQ - Ecological Effects Quotient